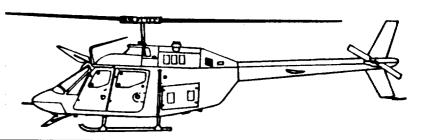
TECHNICAL MANUAL

OPERATORS, AVIATION UNIT,
AND AVIATION
INTERMEDIATE MAINTENANCE



BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR

FOR

H E L I C O P T E R ,

O B S E R V A T I O N

O H - 5 8 A & O H - 5 8 C

ITEM NSN
INSIDE FRONT COVER

This publication supersedes TM 55-1520-228-BD dated 17 August 1990.

CHAPTER 1. GENERAL INFORMATION

CHAPTER 2. ASSESSING BATTLEFIELD DAMAGE

CHAPTER 3. GENERAL REPAIR

CHAPTER 4. AIRFRAME

CHAPTER 5. ALIGHTING GEAR

CHAPTER 6. POWER PLANT

CHAPTER 7. ROTORS

CHAPTER 8. DRIVE TRAIN SYSTEM

CHAPTER 9. HYDRAULIC SYSTEM

CHAPTER 10: INSTRUMENT SYSTEMS

CHAPTER 11. ELECTRICAL SYSTEM

CHAPTER 12. FUEL SYSTEM

CHAPTER 13. FLIGHT CONTROLS

CHAPTER 14. UTILITY SYSTEM

CHAPTER 15. ENVIRONMENTAL CONTROL SYSTEM

CHAPTER 16. MISSION EQUIPMENT

CHAPTER 17. EMERGENCY EQUIPMENT

APPENDIX A . REFERENCES

APPENDIX B. SPECIAL OR FABRICATED TOOLS

APPENDIX C. EXPENDABLE/DURABLE SUPPLIES & MATERIALS

APPENDIX D. SUBSTITUTE MATERIALS/PARTS

APPENDIX E. BDAR TRAINING PROCEDURES

APPENDIX F. AVIONICS CONFIGURATIONS

BDAR FIXES SHALL BE USED ONLY IN COMBAT AT THE DISCRETION OF THE COMMANDER AND SHALL BE REPAIRED BY STANDARD MAINTENANCE PROCEDURES AS SOON AS PRACTICABLE AFTER THE MISSION IS COMPLETED.

BDAR TECHNIQUES IN THIS MANUAL PERTAIN to the following helicopters:

OH-58A Helicopter, Observation NSN 1520-00-169-7137

OH-58C Helicopter, Observation NSN 1520-01-020-4216

WARNING DATA

Personnel performing operations, procedures, and practices which are included or implied in this technical manual shall observe the general following warnings. Disregard of these warnings can cause serious injury or death.

WARNI NGS

FLIGHT SAFETY

The standards contained herein allow aircraft to be flown with battle damage substantially in excess of peacetime limits. Under no circumstances shall this manual be used entirely or in part for peacetime maintenance of the aircraft. Assessment of aircraft battle damage requires extreme care and diligence and strict adherence to the instructions and standards contained in this manual. If at any stage of damage assessment the assessor believes that oversights or errors have been made, the assessment shall be stopped at that point and repeated from the beginning. Under no circumstances shall the requirements of this manual be waived or-circumvented without the express approval of the commander or his designated representative.

EXPLOSI VES

Battle damaged areas should be inspected for unexploded ordnance before attempting repairs. Disposal of unexploded ordnance should be accomplished by qualified personnel.

ARMAMENT

Loaded weapons or weapons being loaded or unloaded shall be pointed in a direction which offers the least exposure to personnel or property in the event of accidental firing. personnel shall remain clear of hazardous area.

CLEANING SOLVENTS

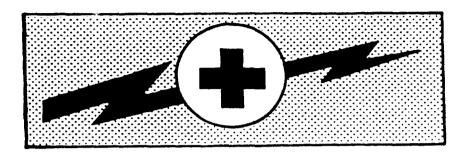
Cleaning solvents may be flammable and toxic. Use only in well-ventilated areas. Avoid inhalation of vapor and skin contact. Do not use solvents near open flame or in areas where very high temperatures prevail. Solvent flash point must not be less than 100°F.

COMPRESSED ALR

Compressed air can blow dust into eyes. Wear eye protection. Do not exceed 30 psig air pressure.

ELECTROLYTE

Battery Electrolyte (Potassium Hydroxide) is corrosive. Wear rubber gloves, apron, and face shield when handling leaking batteries. If potassium hydroxide is spilled on clothing or other material, wash immediately with clean water. If spilled on personnel, immediately start flushing the affected area with clean water. Continue washing until medical assistance arrives.



HIGH VOLTAGE

is used in this equipment.

DEATH ON CONTACT

may result if personnel fail to observe safety precautions.

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Whenever the nature of the operation permits, keep one hand away from the equipment as to reduce the hazard of current flowing through vital organs of the body.

Do not be mislead by the term "low voltage. " Potentials as low as 50 volts may cause death under adverse conditions. For Artificial Respiration, refer to FM 21-11.

EXTERNAL STORES

Prior to any helicopter maintenance functions that require external stores be removed, JETTISON cartridge shall be removed. To prevent injury to personnel and damage to equipment, remove jettison cartridges from stores ejection device prior to placing helicopter in a hangar.

All ground safety pins must be removed before flight. Failure to do so will prevent emergency jettison of stores.

FIRE EXTINGUISHER

Exposure to high concentrations of monobromotrifluoromethane (CF3BR) extinguishing agent or decomposition products should be avoided. The liquid should not be allowed to come into contact with the skin, as it may cause frost bite or low temperature burns.

FUELING AND FUEL REPAIRS

When refueling helicopter, the refueling vehicle must be parked a minimum of 20 feet from the helicopter. Before starting the fueling operation, always insert fueling nozzle grounding cable of fuel truck into GROUND HERE receptacle. Refer to FM 10-68. When defueling, turn off all electrical switches and disconnect external power from the helicopter. The helicopter must be electrically grounded prior to defueling.

Fuel line and tank repairs often involve handling of highly flammable material. Mishandling can result in serious injury or death.

GROUNDING HELICOPTER

The helicopter should be electrically grounded when parked to dissipate static electricity. Turn off all power switches before making electrical connections or disconnections.

HIGH PRESSURE

Extremely high pressure can occur during and after operation of certain equipment. If this pressure is not relieved before working on this equipment, serious injury or death may occur. Be sure to open all drains and vents before beginning disassembly.

HYDRAULIC FLUID

Prolonged contact with liquid or mist can irritate eyes and skin. Wear rubber gloves when handling liquid. After contact with skin, inmmediately wash contacted area with soap and water. If liquid contacts eyes, flush immediately with clear water. If liquid is swallowed, do not induce vomiting, get immediate medical attention. If prolonged exposure with mist is likely, wear an appropriate respirator. When fluid is decomposed by heating, toxic gases are released.

LI FTI NG

Lifting or moving heavy equipment incorrectly can cause serious injury. Do not try to lift or move more than 50 pounds by yourself. Bend legs while lifting. Do not support heavy weight with your back. Always use assistants during lifting operations. Use guide ropes to move hanging assemblies. Lack of attention or being in an improper position during lifting operations can result in serious injury. Pay close attention to movements of assemblies being lifted. Do not stand under lifted assembly or in a position where you could be pinned against another object. Watch your footing.

NOI SE

Sound pressure levels in and around this aircraft during operating conditions exceed the Surgeon General's hearing conservation criteria, as defined in TB MED 501. Hearing protection devices such as aviator helmet or ear plugs are required to be worn.

RADIOACTIVE MATERIALS

Self-luminous dials and ignition units may contain radioactive materials. If such an instrument or unit is broken or becomes unsealed, avoid personal contact. Use forceps or gloves made of rubber or polyethylene to pick up contaminated material. Place materials and gloves in a plastic bag. Seal bag and dispose of it as radioactive waste in accordance with AR 708-1 and TM 3-261 (Refer to TB 43-0108). Repair shall conform to requirements in AR 385-11.

SANDING DUST

Sanding on reinforced laminated glass produces fine dust that may cause skin and lung irritations. Observe necessary protective measures.

STARTING HELICOPTER

Starting and operation of the helicopter will be performed only by authorized personnel.

TOXIC POISONS

Turbine fuels, lubricating oils, and adhesives contain additives which are poisonous and readily absorbed through the skin. Do not allow them to remain on skin longer than necessary. Wear protective equipment.

Technical Manual No, 55-1520-228-BD

U.S. ARMY AVIATION SYSTEMS COMMAND 4 January 1991

TECHNICAL MANUAL

BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR

FOR

OH-58A AND OH-58C HELICOPTER

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of away to irnprove the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander, U.S. Army Aviation Systems Command, AtTN: AMSAV-MC, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished to you.

TABLE OF CONTENTS

		Page
	HOW TO USE THIS MANUAL	viii
CHAPTER 1	- GENERAL INFORMATION	
Section II	Introduction	1-1 1-3 1-5
CHAPTER 2	- ASSESSING BATTLEFIELD DAMAGE	
	Introduction	2-1 2-3
CHAPTER 3	- GENERAL REPAIRS	3-1
CHAPTER 4	- AIRFRAME	
	Introduction	4-1 4-49
CHAPTER 5	- ALIGHTING GEAR	
Section II	Introduction	5-1 5-1 5-4
CHAPTER 6	- POWER PLANT INSTALLATION	
Section I. Section II	Introduction	6-1 6-1

i

TM 55-1520-228-BD

TABLE OF CONTENTS (Cont)

		Page
CHAPTER 7 - R	OTORS	
	Introduction	7 - 1 7 - 1
CHAPTER 8 -	DRIVE TRAIN SYSTEM	
	Introduction	8-1 8-1
CHAPTER 9 - H	IYDRAULI C	
Section II.	Introduction. Li nes and Hoses. Seals, Packings, and Gaskets	9-1 9-1 9-14
CHAPTER 10 -	INSTRUMENTS	
Section I. Section II.	Introduction	10-1 10-6
CHAPTER 11 -	ELECTRICAL AND AVIONICS SYSTEM	
Section I. Section II.	Introduction	11-1 11-6
CHAPTER 12 -	FUEL SYSTEMS	
	Introduction	12-1 12-1 12-4
CHAPTER 13 -	FLIGHT CONTROLS SYSTEM	
Section I. Section II.	Introduction	13-1 13-1
CHAPTER 14 -	UTILITY SYSTEMS	
Section I. Section II.	Introduction	14-1 14-1
CHAPTER 15 -	ENVIRONMENTAL CONTROL SYSTEM	
Section I. Section 11. Section III.	Introduction,	15-1 15-1 15-9

Page

TABLE OF CONTENTS (Cont)

CHAPTER 16 -	HOIST AND WINCHES	16-1
CHAPTER 17 -	AUXILIARY POWER PLANT	17-1
CHAPTER 18 -	MISSION EQUIPMENT	
Section I. Section II.	Introduction	18-1 18-1
CHAPTER 19 -	EMERGENCY EQUI PMENT	19-1
APPENDIX C - APPENDIX E - APPENDIX F - GLOSSARY	REFERENCES SPECIAL OR FABRICATED TOOLS EXPENDABLE/DURABLE SUPPLIES AND MATERIALS SUBSTITUTE MATERIALS/PARTS. BDAR TRAINING PROCEDURES. AVIONICS CONFIGURATION.	C-1 D-1 E-1 GLOS-1
	LIST OF ILLUSTRATIONS	
Figure	Ti tl e	Page
1-1 1-2 1-3 4-1 4-2 4-3 4-4 4-5 4-6 4-7 4-8 4-9 4-10 4-11 4-12 4-13 4-14 4-15 4-16 4-17 4-18 4-19 4-20 4-21 4-22	DA Form 2408-13. DA Form 2408-18. Damage Assessment Markings (Sheet 1 of 3). Aircraft Sections. DA Form 2404. Evaluating Damage to Angles, Channels, and Z-Angles. Damaged Cross Section. Measuring Skin Panel Damage. Measuring Damage in Webs and Panels. Measuring Damage in Honeycomb Sandwich Panels. OH-58 Helicopter. Airframe Reference Lines. Cockpit. Fuselage Pylon Support Structure (Sheet 1 of 5). Upper and Lower Shell Structure. Aft Fuselage Structure. Tail Boom Cowling and Fireballs Typical Former Repair (Sheet 1 of 2) Cutout in Damage Skin. Patch Plate. Typical Patch Plate Repair Expedient Cap/Longeron Repair Repair of Damage Bulkhead Flange Typical Combination Repair (Sheet 1 of 2).	1-7 1-8 1-9 4-3 4-6 4-8 4-9 4-10 4-11 4-13 4-17 4-18 4-19 4-20 4-25 4-26 4-27 4-28 4-52 4-54 4-54 4-56 4-60 4-61

LIST OF ILLUSTRATIONS (Cont)

Fi gure	Ti tl e	Page
4-23	Damaged Honeycomb Core Panel, Small Damage to One Skin	1 / 1
4-24	and Core	4-64
	and Core	4-64
4-25	Repaired Honeycomb Core Panel, 2-8 Inch Damage - One Skin	4 54
4 07	and Core	4-54 4-66
4-26		4-66
4-27	Patch Plates, One Side Accessible Repair	4-00
4-28	Repair of Honeycomb Core Panel, Damage Over 8 Inches - Both Skins and Core	4-67
4-29	Fracture Lacing with Safety Wire	4-69
4-30	Tail Boom Skin Damage	4-70
5-1	Landing Gear and Support Installation	5-2
5-2	Skid Tube Damage Zones	5-2
5-3	Skid Repair	5-5
5-4	Clamp Repair	5-5
5-5	Fabricated Clamp	5-6
6-1	T63 Series Engine	6-2
6-2	Blocking Plate Installation	6-5
6-3	Double-Check Valve System, Possible Alternatives	6-7
6-4	Wood Plug	6-8
6-5	Sealant for Small Holes	6-9
6-6	Repair Using Screw, Washer and Gasket	6-9
6-7	Hose Assembly, Sealant, Nut, and Bolt	6-10
6-8	Sheet Metal with Sealant and/or Cherry Rivets	6-12
7 - 1	Main Rotor System	7-2
7-2	Tail Rotor System	7-3
7-3	Rotor Blades, Damage Sensitive Areas	7-5
7 - 4	Rotor Blade Repair, Application of Tape	7-7
7-5	Repair Areas - Main Rotor B1ades	7-8
8-1	Drive Train System (Sheet 1 of 4)	8-2
8-2	External Components - Transmission Oil System	8-8
8-3	Flex Duct Repair (Sheet I of 2)	8-9
9-1	Hydraulic System	9-2
9-2	Hydraulic System Schematic	9-3
9-3	Two-Part Fitting	9-4
9-4	Four-Part Fitting	9-5
9-5	Using Tube Cutter	9-5
9-6	Properly Burred Tubing	9-7
9-7	Damaged Tube Section-Straight Tube	9-7
9-8	Spliče Repair Assembly	9-8
, 9-9	Repair Fitting and Tube Installation	9-8
9-10	Damaged Tube Section-Complex Bends	9-10
9-11	Spliče Adapter Assembly İnstallation	9-10
9-12	Installation of Socket and Sleeve	9-12

LIST OF ILLUSTRATIONS (Cont)

Fi gure	Ti tl e	Page
9-13	Assembly of MS Fitting	9-12
9-14	Union Connection	9-13
11-1	Circuit Identification	11-2
11-2	Crimp Splice	11-8
11-3	Splicing with Terminal Lug Barrel	11-10
11-4	Twist Wire Splice	11-11
11-5	Replacement Section; Twist Wire Splice	11-12
11-6	Metal Casing Splice Splice	11-12
11-7	Bolted Terminal Lug Repair of Large Wires	11-14
11-8	Replacement Section; Terminal Lug Repair	11-14
11-9	Ram Wire Repair	11-14
11-10	Heat-Shri nkable Tape	11-16
11-11	Insulation Repair with Sleeving	11-16
11-12	Shielded Cable Repair Preparation	11-17
11-13	Shielded Cable Splice Preparation	11-18
11-14	Shi el ded Cable Spliced	11-19 11-20
11-15	Shielded Cable Repair	11-20
11-16	Pigtail Method Repair	11-22
11-17	Substitute Shielded Braid Repair	11-24
11-18 11-19	Shield Terminator Repair Preparation	11-24
11-19	Shield Terminator Repair	11-25
11-20	Nickel-Plated Shield Terminator Repair	11-25
11-21	Terminal Lug Repair.	11-25
11-23	Self-Clinching Cable Strap	11-28
11-24	Self-Clinching Cable Strap and Tool	11-28
11-25	Tile Tape Repair Procedure.	11-29
11-26	Coax Splice Preparation	11-29
11-27	Coax Splice Inner Sleeve.	11-31
11-28	Coax Splice Shield Sleeve.	11-31
11-29	Coax Splice with Tubing Sleeve	11-31
11-30	Coax Splice with Cable Braid over Barrier Sleeves	11-32
11-31	Coax Repair with Cable Braid over Barrier Sleeve	11-32
11-32	Component Bypass	11-33
11-33	Connector Pin and Socket	11-33
11-34	Damaged Connector and Pigtail	11-34
11-35	Circuit Breakers,	11-36
11-36	Typical Circuit Breaker Connection	11-17
11-37	Construction of Fuse Link	11-37
11-38	Splicing Bus Bars	11-39
11-39	Lengthening Bus Bars	11-39
11-40	Battery, Storage BB-476/A, Cell Layout	11-40
11-41	Block Diagram Power Relay, Check and Test	11-41
11-42	Location of Power Relays	11-43
11-43	Block Diagram, Typical Power Relays	11-44
11-44	Jumper Wire Fabrication	11-44
11-45	Frequency vs. Wavel ength	11-46

LIST OF ILLUSTRATIONS (Cont)

Fi gure	Ti tl e	Page
11-46 11-47 12-1 12-2 12-3 12-4 12-5 13-1 13-2 13-3 13-4 13-5 13-6 13-7 13-8 13-9 13-10 13-11 14-1 15-1 15-2 15-3 15-4 15-5 15-6 15-7 F-1 F-2 F-3 F-4 F-5 F-6 F-7 F-8 F-9 F-10	Preparaton of Coax Installation of Field Expedient Antenna. OH-58 Fuel System. Emergency Mechanical Clamp Repair Mixing Instruction for Sealant Cartridges. Rubber Repair Plug Assembly. Plug Modification for Three Plain Repair OH-58 Flight Controls Schematic. Collective Flight Control Cyclic Flight Control Flight Control Actuators. Anti-Torque Controls (Sheet 1 of 2). Control Tube Di mensions. Suggested Repair for Control Rods or Tubes Control Rod with Bearing and Clevis Assemblies Flattened End of Fabricated Flight Control Corner Rounding on Fabricated Flight Control Bearing Assembly Connection of Fabricated Flight Control Bearing Assembly Connection of Fabricated Flight Control Engine De-Ice System. Bleed Air Heating and Ventilating System A & C Heating and Ventilating System (Bleed Air) A Model Heating and Ventilating System (Bleed Air) C Model Combustion Heater. Shroud Heater System Schematic Bleed Air Line Installation. Bleed Line Patch Repair. Intercom System (Sheet 1 of 2). UHF/AM Communications System and Connecting Cables VHF/FM Communications System Gyromagnetic Compass Set AN/ASN-43 and Connecting Cable (Sheet 1 of 2) Direction Finder Set AN/ARN-89 (Sheet 1 of 2). Radar Altimeter System AN/APN-209. Transponder (IFF) System AN/APN-209. Transponder (IFF) System AN/APN-209.	11-47 11-49 12-2 12-5 12-7 12-9 13-2 13-5 13-6 13-7 13-8 13-10 13-12 13-13 13-13 14-2 15-2 15-3 15-4 15-5 15-6 15-10 15-11 F-2 F-4 F-6 F-8 F-10 F-12 F-14 F-16 F-18 F-21
	LIST OF TABLES	
Table No.	Ti tl e	Page
2-1 2-2 4-1 4-2 4-3 4-4 4-5	General Decision Logic	2-2 2-3 4-2 4-31 4-36 4-39 4-39

LIST OF TABLES (Cont)

Table No.	Ti tl e	Pa
4-6 4-7	Damage Limits Aft Fuselage - Condition II	4 -
4-8	Metal Substitution Chart	4 -
5-1	Assessment Procedure Logic	5.
6-1	Engine BDAR Assessment Logic	6.
7-1	Assessment Procedures	7.
8-1	Drive Train System BDAR Assessment Procedures	8-
9-1	Assessment Logic	9.
9-2	Seals Reference and Temperature Guides Chart	9.
11-1	Electrical and Avionics Assessment Logic	1
11-2	Function and Designation Letters	1
11-3	Unshielded Crimp Splice Application	1
11-4	Wire Repair Segments	1
11-5	Shi el ded Cabl e Repair	1
11-6	Terminal Lugs	1
11-7	Fuse Link Strands	1
12-1	Fuel System Assessment Procedures	1.
13-1	Flight Control System Assessment Procedures	1
13-2	Nominal Tube Splice Sizes	1
13-3	Bolt/Drill Sizes for Control Tube Repairs	1
15-1	Assessment Procedures	1
D-1	Essential Spare Parts	D
D-2	Spare and Repair Parts	D
D-3	Weapons	D
D-4	Substitute Fuels for JP-4 Fuel	D
D-5	Fuels for the OH-58 Helicopter	D
D-6	Substitute Commercial Fuels	D
D-7	Alternate and Expedient Fuel Blends	D
F-1	Wire Table, Intercom System	F
F-2	Wiring Table, UHF/AM Communication System	F
F-3	Wiring Table, VHF/AM Communication System	F
F-4	Wiring Table, VHF/FM Communication System	F
F-5	Wiring Table, Gyromagnetic Compass Set	F
F-6	Wiring Table, ADF AN/APN-89	F
F-7	Radio Receiving Set AN/ARN-123(V), OH-58C	F
F-8	Wiring Table, Radar Altimeter AN/APN-209, OH-58C	F
F-9	Wiring Table, Radar Arthmeter ANYARN-207, 0H-366	F
F-10	Wiring Table, IFF, APX-100, OH-58C	F
F-10 F-11	Wiring Table, AN/APR-39	F
F -	WITTING TADIE, ANTAPK-39	Г

HOW TO USE THIS MANUAL

This manual is developed to assist the soldier in a battlefield environment to make assessment and repair of damage to the OH-58 helicopter which cannot, due to asset availability or environmental factors, be repaired in the normal prescribed manner. Within this technical manual, the word shall is used to indicate a mandatory requirement. The word should is used to indicate a nonmandatory but preferred method of accomplishment. The word may is used to indicate an acceptable method of accomplishment.

- 1. Organization of the Manual. This manual contains a general information chapter (chapter 1), a general assessment chapter (chapter 2), and specific repair chapters (chapters 4 thru 19). Chapter 3 is not used. It also contains five appendices. References (Appendix A), special or fabricated tools (Appendix B), expendable/durable supplies and materials list (Appendix C), substitute materials and parts (Appendix D), and BDAR fixes authorized for training (Appendix E).
- 2. Chapter 2 is used to assess the helicopter in general and references specific chapters for detailed repair procedures of the major functional groups. The major functional groups correspond with the functional groups of the -23 series manuals that are employed in routine repairs to the helicopter.
- 3. Chapter 3 is not used in this manual. It would normally contain repairs for equipment which does not fall under one of the standard helicopter functional groups.
- 4. Each functional group chapter is organized as follows:
 - a. Section I Introduction.
 - (1) Scope. Purpose of the chapter.
- (2) Assessment procedures. General assessment information for the repairs covered therein.
 - (3) Repair procedure index.
- b. Section II Repair Item. A subsection is included for each repair item covered in that functional group. It contains the following:
 - (1) General. About the nature and cause of damage and repair.
 - (2) I tem and trouble statement with:
 - (a) Limits given.
 - (b) Personnel and time required to effect repairs.
 - (c) Materials and tools needed.
 - (d) Procedural steps to accomplish the repair.
- (3) If more than one method of repair can be used, the various options will be included next.

NOTE

The first option is the preferred choice, the second option is the next preferred, etc. Selection of the option should be the most preferred method possible under the circumstances and with the available materials and manpower.

HOW TO USE THIS MANUAL (Cont)

- 5. Finding Repairs in this Manual.
- a. When the damage is obvious and known, find the functional group chapter of which the damaged item is a part. Turn to the repair procedure index, section I, subparagraph c of each chapter to locate the item being repaired. Then turn to the repair section and review each option to ascertain the appropriate fix. Read the entire section for the option, then effect the repairs following the procedures given.
- b. When the damage is hidden and/or unknown, follow the overall assessment procedures provided in chapter 2, and follow the procedures and directions provided.
- 6. Preparation.
- a. Each mechanic/technician shall have read chapters 1 and 2 and become familiar with the repairs and layout of the manual prior to attempting to accomplish BDAR repairs.
- b. All warnings, cautions, and safety precautions shall be followed, inasmuch as possible, at all times during BDAR procedures so as not to further damage and/or jeopardize either personnel or the equipment during or subsequent to the BDAR action. Ensure all documentation is completed as directed in this manual and by local command.
- 7. Expendable/Durable Supplies and Materials.
- a. Each fix or repair option contains a short listing of materials and tools considered basic to the repair. It is important to note that the expendable materials listed usually cover a wide range for any one item.

Example: MATERIALS/TOOLS REQUIRED:

- •Drill with Bit
- Sheet Metal (items 131-142, Appx C)
- •Rivets (items 98-115, Appx C)

In this example, sheet metal covers the range of items 131 thru 142 in Appendix C. This means that, depending on the circumstances and location of the fix, any one of these metals could be used. Likewise any one of the rivets, items 98 thru 115, may be used to attach the patch plate depending on the application.

b. One of the key points concerning successful BDAR repairs is flexibility. The users of this manual should strive to use the items on hand, provided a safe repair is made. The stringent requirements of normal maintenance may be lifted.

CHAPTER 1

GENERAL INFORMATION

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

1-1. PURPOSE. The purpose of Battle Damage Assessment and Repair (BDAR) is to quickly return the disabled helicopter to the operational commander by expediently fixing, bypassing, or juryrigging components to restore the minimum essential systems required for the support of the specific combat mission for self-recovery. These repairs will be temporary and may not restore full performance capability. Standard repair will be completed as soon as practical.

1-2. SCOPE.

- a. This technical manual (TM) describes BDAR procedures applicable to OH-58 helicopter series, and these procedures are to be used by crew, operators, aviation unit maintenance (AVUM) teams, and aviation intermediate maintenance (AVIM) support teams.
- b. Standard repair techniques for the OH-58 helicopter are included in other technical manuals which are referenced in Appendix A of this TM. Details of these procedures are not duplicated in whole in this TM. If the repairs are more than one page in length, the repairs may only be referenced in appropriate chapter.
- c. All possible types of combat damage and failure modes cannot be predicted, nor are all effective field expedient repairs known. This TM provides guidelines for assessing and repairing battlefield failures of OH-58 helicopters and is not intended to

- be a complete catalog of all possible emergency repairs. The repairs described here will serve as guidelines and will stimulate the experienced mechanic/ operator to devise repairs as needed to rapidly return equipment to operation in a combat situation.
- d. The direct replacement of a piece of equipment by its spare, even under battlefield conditions, is not a BDAR fix and may not be covered is in this TM. A standard procedure should be performed in preference to a BDAR fix when time and spares are available.

1-3. APPLICATION.

a. The procedures in this manual are designed for battlefield environments and should be used in situations where standard maintenance procedures are impractical. These procedures are not meant to replace standard maintenance practices, but rather to supplement them strictly in a battlefield environment. Standard maintenance procedures will provide the most effective means of returning damaged equipment to ready status provided that adequate time, replacement parts, necessary tools, and trained/qualified repair persons are available. BDAR procedures are only authorized for use in an emergency situation in a battlefield environment, and only at the direction of the commander. They are not to be continued after the equipment is out of the battle environment.

- b. BDAR techniques are not limited to simple restoration of minimum functional combat capability. If full functional capability can be restored expediently with a limited expenditure of time and assets, it will be accomplished.
- c. Some of the special techniques in this manual, if applied, may result in shortened life or in further damage to major components of the helicopter. The commander must decide whether the risk of having one less helicopter available for combat outweighs the risk of applying the potentially destructive expedient repair technique. Each technique gives appropriate warnings, cautions, and lists systems limitations caused by this action.

1-4. DEFINITIONS.

- a. <u>Battlefield Damage</u>. Any incident such as combat damage, random failures, operator errors, accidents, and wear-out failures which occur on the battlefield and which prevent the helicopter from accomplishing its mission.
- b. Repair of Fix. Any expedient action that returns a damaged part or assembly to a full or an acceptably degraded operating condition, including:
- (1) Short cuts in parts removal or installation.
- (2) Installation of components from other equipment that can be modified to fit or interchange with components on the damaged equipment.
- (3) Repair using parts that serve a noncritical function elsewhere on the same equipment for the purpose of restoring a critical function.
- (4) Bypassing of noncritical components in order to restore basic functional capability.
- (5) Expeditious cannibalization procedures.

- (6) Fabrication of parts from kits or readily available materials.
 - (7) Jury-rigging.
 - (8) Use of substitute materials.
- c. Damage Assessment. A procedure to rapidly determine what is damaged, whether it is repairable, what assets are required to make the repair, who can do the repair (e.g., crew, maintenance team or maintenance support team), and where the repair should be made. The assessment procedure includes the following steps:
- (1) Determine if the repair can be deferred, or if it must be done.
- (2) Isolate the damaged areas and components.
- (3) Determine which components must be fixed.
 - (4) Prescribe fixes.
- (5) Determine if parts or components, materials, and tools are available.
- (6) Estimate the manpower and skill required.
- (7) Estimate the total time (clock hours) required to make the repair.
- (8) Establish the priority of the fixes.
- (9) Decide where the fix shall be performed.
- (10) Decide if recovery or evacuation is necessary and to what location.
- d. <u>Fully Mission Capable (FMC)</u>. The helicopter can perform all its combat missions. To be FMC, the helicopter must be complete and fully operable with no faults listed in the aircraft inspection and maintenance record as prescribed in DA PAM 738-751.

- e. Combat Capable. Equipment meets the minimum functional combat capability requirements. (See paragraph 1-8.)
- f. Combat Emergency Capable. The equipment meets the needs for specific tactical missions; however, all systems are not functional. Also, additional damage due to the nature of an expedient repair may occur to the equipment if it is used. The commander must decide if these limitations are acceptable for that specific emergency situation.
- g. Cannibalization or Controlled Exchange. Throughout this manual, cannibalization and controlled exchange are used interchangeably meaning the removal of an item of materiel from one piece of equipment for immediate use in another. Generally the rules for cannibalization/controlled exchange provided in TM 55-1500-328-25, as modified by local authority, will prevail.
- h. Evacuation, A combat service support function involves the movement of recovered helicopters from a main supply route, maintenance collection point, or maintenance activity to higher categories of maintenance. The materiel may be returned to the user, to the supply system for reissue, or to property disposal activities.
- i. Re<u>covery</u>. The retrieval of immobile, inoperative, or abandoned OH-58 helicopter from the battlefield or immediate vicinity, and its movement to a maintenance collection point, the main supply route, or a maintenance activity for disposition, repair, or evacuation.

- j. Self-Recovery. The ability of a battle damaged helicopter to retrieve itself (fly out) from a battlefield environment. It usually will involve flying with degraded flight status and with restrictions and limitations placed on performance characteristics such as limitations placed on weight, airspeed, engine torque, and other characteristics. In BDAR repairs, the limitations recommended should be followed. Emergency flight procedure in TM 55-1520-228-10 should further be consulted.
- k. <u>Maintenance Collection Point</u>. A point operated by AVIM unit for the collection of equipment for repair.
- 1. Maintenance Support Team (MST). A team of AVIM mechanics and technical specialists who are trained in assessing battlefield damage and field repair procedures.
- m. Maintenance Team (MT). Helicopter crew chief or AVUM mechanics/technicians who are trained in assessing battlefield damage and field repair procedures.
- 1-5. QUALITY DEFICIENCY REPORT/EQUIP:
 MENT IMPROVEMENT RECOMMENDATION
 (QDR/EIR) . If your helicopter and
 equipment need improvement, let us
 know: Send us an EIR. You, the user,
 are the only one who can tell us what
 you don't like about your equipment.
 Let us know why you don't like the
 design. Put it on an SF 368 (Quality
 Deficiency Report). Mail it to
 Commander, U.S. Army Aviation Systems
 COMMand, ATTN: AMSAV-QF, 4300
 Goodfellow Boulevard, St. Louis, MO
 63120-1798. We'll send you a reply.

Section II. STANDARDS AND PRACTICES

1-6. BDAR CHARACTERISTICS. BDAR capability requires simplicity, speed, and effectiveness. Some BDAR procedures include repair techniques that violate

standard peacetime maintenance practices In a combat emergency situation, greater risks are sometimes necessary and acceptable.

- 1-7. WAIVER OF PRECAUTIONS. Under combat conditions, BDAR may be performed on helicopters which are in flight or which are under power while on the ground. While some of these BDAR actions may require waiving of safety precautions, the cautions to protect personnel life should not be overlooked. Other similar precautions may be waived at the discretion of the commander. BDAR fixes may be required in a chemically toxic environment or under other adverse battlefield conditions with severe limitations in personnel, facilities, equipment, and materials. Performance of repair tasks may be necessary while wearing protective gear. Decontamination procedures are described in FM 3-5.
- 1-8 OPERATING CHARACTERISTICS. This manual covers expedient repairs for the OH-58 helicopter and its components. It is entirely possible that in a combat situation, the helicopter having undergone one or more repairs may suffer degradation of its normal operating characteristics (e.g., reduced speed, reduced load capability, reduced range, etc.), and still be able to carry out all or parts of an assigned mission. The minimum functional combat capability (MFCC) criteria for the OH-58 is as follows:
- a. Flight Capability for Mission Completion. Helicopter's flight characteristics degraded to a minimum of combat capable (CC).
- (1) Sufficient power delivered to main and tail rotor to accommodate lift capability for helicopter crew and cargo.
- (2) No fuel leaks which will curtail the intended length of flight.
- (3) No degradation of any component/system which will end in failure and curtailment of intended mission.

(4) Communications. Must have intercom communications within aircraft and at least two tactical receivertransmitter (R-T) units operating at full capability.

NOTE

Criteria may be waived for recovery or if the tactical situation demands otherwise.

- b. Flight Capability for Self-Recovery Capability (SRC).
- (1) Must have power delivered to main and tail rotor at acceptable limits.
 - (2) Maximum engine torque:

80% at 0 kts 64% at 16 kts 53% at 32 kts 50% at 50 kts

- (3) Lift capability for crew members. Unload unnecessary weight.
- $\mbox{(4)}$ Flight controls at minimum function level acceptable for flight.
- (5) Instruments/avionics as required to meet mission needs.
 - (6) Maximum airspeed of 50 kts.
- (7) Maximum flight duration of 2 hours. Consideration will be given to minimize flight duration.
- (8) Be prepared for emergency procedures. See TM 55-1520-228-10, Chapter 9.

WARNING

Careful consideration shall be given to the operation of the Identify Friend or FOE (IFF), Mode 4, avionics system. Failure of the IFF or failure to properly communicate with area air defense command prior to liftoff could result in an attack from friendly forces due to mistaken identity.

1-9. TRAINING.

a. BDAR by its nature involves fixes, bypasses, and/or jury-rigging, which is

outside authorized standard repairs, and may degrade the inherent safety of the helicopter. Therefore, BDAR actions are not intended to supplement, replace standard maintenance practices during peacetime, nor should they be employed indiscriminately to facilitate training.

b. Repairs described in this manual, which can be appropriately accomplished in order to provide training, are listed in Appendix E and are highlighted in each repair chapters repair procedure index. The trainable repair in the index will be blocked in.

Section III. TASKS AND RESPONSIBILITIES

1-10. TAGGING/IDENTIFYING BDAR REPAIRS.

- a. All damage will be identified on aircraft inspection and maintenance record, DA Form 2408-13 and DA Form 2408-18, as per DA PAM 738-751. See Figures 1-1, 1-2.
- b. Recording of BDAR repairs and the use of status symbols, as defined in DA PAM 738-751, will be completed as soon as practical to indicate any limitations and restrictions or required standard repairs.
- c. In addition to recording all damage, the area damaged will be marked on aircraft or component part using damage assessment markings as shown in Figure 1-3.
- d. Status Symbols. Status symbols used in aircraft logbooks to record defects are defined below.
- (1) Red "X." A red "X" shows that a defect exists and the aircraft is unsafe for flight.

- (2) Circled red "X." A red "X" inside a red circle indicates a limiting defect. The aircraft may be flown under specific limits as directed by higher authority, or as directed locally until corrective action is taken.
 - (3) Red horizontal dash (-).
- (a) This symbol indicates an inspection, special inspection, component replacement, maintenance operational check, or test flight is needed. The symbol is also used to indicate that a normal modification work order (MWO) is overdue.
- (b) This symbol also shows that the condition of the equipment is unknown. A potentially dangerous condition may exist. The condition will be corrected as soon as possible.
- (4) Red diagonal (/). This symbol indicates a defect exists that is not serious enough to ground the aircraft.

TM 55-1520-228-BD GENERAL INFORMATION

- e. Maintenance of Forms. Instructions for the maintenance of forms, records, and reports are listed in DA PAM 738-751 and TB 55-1500-307-24. When battle damage assessment and repair (BDAR) becomes necessary, the procedures in DA PAM 738-751 will apply. Refer to Figures 1-1 and 1-2 for examples.
- (1) In block 17 of DA Form 2408-13, list the fault.
- (2) In block 16 of DA Form 2408-13, enter the status symbol.
- (3) In block 18 of DA Form 2408-13, enter the corrective action taken.
- (4) The individual completing the repair will sign the form in block 19 opposite the first line of the action taken, and will place his last name initial over the status symbol in block 16.
- f. Temporary Repair. If the repair is temporary, take the following additional action:
- (1) In block 18 of DA Form 2408-13, enter the corrective action and a statement that the repair is temporary. Then make an entry in DA Form 2408-14, block b. The entry will be a duplicate of the entry in block 17 of DA Form 2408-13 to include a statement that a temporary repair has been made.
- (2) If the temporary repair limits the capability of the aircraft, the following entry will be made on DA Form 2408-13:
- (a) Place a circled red "X" in block 16.
- (b) State the limitation in block 170.

- (3) If the temporary repair requires an inspection at intervals, list the required inspection on DA Form 2408-18.
- (a) Enter item to be inspected in block 5.
- (b) List the applicable TM in block 6.
- (c) State the frequency of the inspection in block 7.
- 1-11. REPORTS. All written reports required for BDAR fixes are found in DA PAM 738-751. If the helicopter can no longer fly, the aircraft commander should immediately initiate an out-of-action report to his superior. If communications capability is damaged, the aircraft commander should approach the nearest friendly radio and make his report if possible. The report should include these essentials:
- a. Aircraft damage (out-of-action or function partially impared).
 - b. Location of aircraft.
 - c. Defense status.
 - d. Mobility.
 - e. Personnel report.
- f. Current and anticipated hostile action.
- $\ensuremath{\mathtt{g}}_{\boldsymbol{\cdot}}$ Anticipated BDAR fixes and repair time.

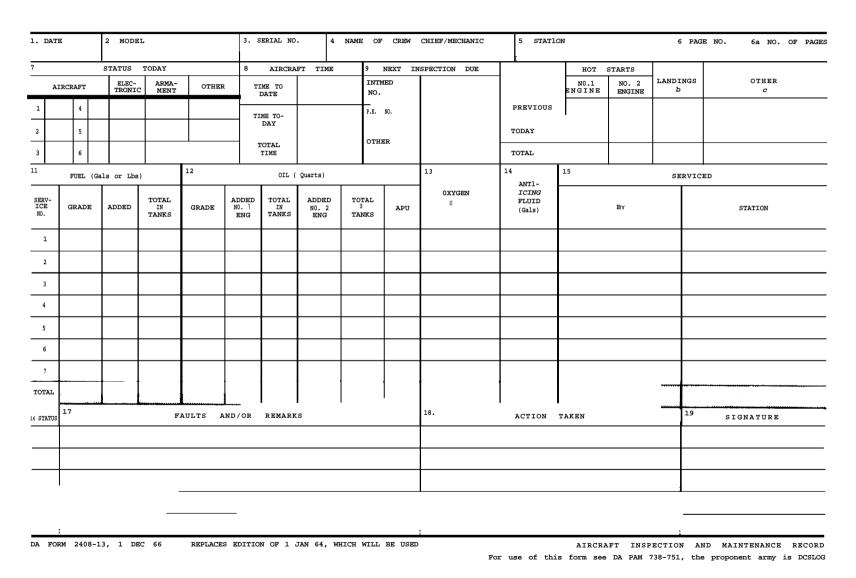


Figure 1-1. DA Form 2408-13

1. NOMEN CLATURE		2. MODEL	3. SERIAL NUMBE	R	4. PAGE NO.
					NO. OF PAGES
5. ITEM TO BE	INSPECTED	6. REEFERENC	DE	7. FREQUENCY	8. NEXT DUE

DA FORM 2404.18. 1 JAN 64

EQUIPMENT INSPECTION LIST For use of this form, see TM 38-750; the proponent agency is DCSLOG.

Figure 1-2. DA Form 2408-18

MEANINGS MARKINGS

TO INDICATE DAMAGE HAS BEEN ASSESSED AND EVALUATED:

Draw a circle around the damage.

TO INDICATE NO BDAR REPAIR REQUIRED:

Write "OK" inside the circle.

TO INDICATE STRUCTURAL REPAIRS ARE REQUIRED:

Draw a second line about 1/4 to 1/2 way around the initial circle then draw slashes or crosshatch between the two circular lines.

STRINGER REPAIR: Place an X to the left and right of the circle.

FRAME REPAIR: Place an X above and below the circle.

TO INDICATE DAMAGE TO SYSTEMS REQUIRING REPAIRS:

Draw a series of "curly cue" lines about 1/4 to 1/2 way around the initial circle.

TO INDICATE REPAIR INSTRUCTIONS:

For internal damage - draw a dashed circle around the repair instructions.

For external damage - write repair instructions but do NOT enclose with a circle.

















REPAIR INSTRUCTIONS

REPAIR INSTRUCTIONS

PARTIAL

Figure 1-3. Damage Assessment Markings (Sheet 1 of 3)

WRITTEN INSTRUCTIONS

See me - print name & rank. (Signature)	See assessor or whoever has signed written instructions for additional information.
Names of parts to be repaired, (item, skin, stringer.	Where compound damage occurs, the names or abbreviations of specific items can be written adjacent to the damage to clarify repair instructions.
Full	A full strength repair is required.
Partial	Partial strength repair required in accordance with specific aircraft BDAR manual.

MEANING

No repairs required - damage is within acceptable limits OK

for battle conditions.

Continual assessment or reinspection is required after

each sortie.

Instruction markings for system are in two parts:

(1) Repair instruction markings and meanings are shown on this sheet and are used to indicate repair actions required.

(2) System Identification - When known, identify the system using markings shown on sheet 3 of this figure.

MARKINGS	<u>MEANING</u>
Fix	Repair the damaged system in accordance with approved standard BDAR techniques for type of system, item, high pressure, low pressure, etc.
Cap	Terminate or block the system to prevent leakage.
Repl	Replace damaged part - repairs not acceptable.
OK	No repairs required.
Tag	Repair instructions are written on tags tied to individual damaged lines/components.

Figure 1-3. Damage Assessment Markings (Sheet 2 of 3)

System identification markings are primarily abbreviations of the system.

<u>MARKINGS</u>	SYSTEM/MEANING
Sys	Damage to unknown system.
Fuel	Fuel
Hyd	Hydraulic
НР	High Pressure
LP	Low Pressure
Elect	Electrical
AV	Avionics
Flt Cont	Flight Control
Main Rotor	Main Rotor Group
Tail Rotor	Tail Rotor Group
Air	Pneumatic
Air Cond	Air Conditioning
BL Air	Bleed Air System
BLC	Boundary Layer Control
$N_{_2}$	Nitrogen
$O_{\scriptscriptstyle 2}$	Oxygen
Eng Contr	Engine Control
Pow Tr	Power Train
EJ	Ejection

NOTE

More than one identification marking may be used to describe the system (e.g., ${\tt HP}$, ${\tt Hyd}$).

Figure 1-3. Damage Assessment Markings (Sheet 3 of 3)

CHAPTER 2

ASSESSING BATTLEFIELD DAMAGE

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

2-1. SCOPE.

- a. This chapter provides guidelines to use in assessing battlefield damage to the OH-58 helicopter. It directs you to an expedient BDAR fix or to the standard system fix of TM 55-1520-228-23-1,2 if an expedient BDAR repair does not exist. General decision logic chart, Table 2-1, assists in BDAR discussions.
- b. Each chapter will have a specific fault assessment chart for each functional group and this flow chart will direct you to specific BDAR fixes for and within the functional group.
- c. Use the following guidelines to find and fix sustained damage or suspected damage to your helicopter. Keep in mind that damage can be sustained while on the ground or in flight. The helicopter location can have a considerable effect on the assessment. The following appraisal shall be accomplished.
- (1) If possible and time permits, inspect and check the helicopter using operator's check list (CL), operator's manual (-10), and other records and forms kept in aircraft log book. At the same time be looking for obvious damage to aircraft.

- (2) Inapplicable and possible, use standard troubleshooting recommendations in TMs.
- (3) If you find a problem, determine its effect on helicopter's mobility and capability.
- (4) If you cannot fix the problem with standard fixes, apply this TM and use general and specific assessment tables, charts, and BDAR action.
- (5) If the damage does not affect aircraft's flying status, the aircraft or flight commander will decide whether to fix or defer fix, and continue or start mission.
- (6) If damage <u>does affect flight</u> status, do one of the following:
- (a) Replace damaged part with a serviceable part.
- (b) Replace damaged part with suitable substitute if it exists.
 - (c) Apply a BDAR fix.
- (7) After repairing the damage, replace all lost fluids/lubricants. If one specified by aircraft TM is not available, refer to Appendix D for alternative materials/parts.

AIRCRAFT SUSTAINS OR SUSPECT DAMAGE IN FLIGHT? ON GROUND NO YES IN FLIGHT GROUND ASSESSMENT **ASSESSMENT** AND REPAIR CONTINUE FORCED CAN AVUM FIX? NO FLIGHT? NO LANDING YES YES OTHER CONTINUE NO DAMAGE? NO MISSION YES YES CONTINUE FORCED CAN AVIM FIX? NO FLIGHT? LANDING YES YES NO ABORT RETURN TO BASE YES MISSION? NO MISSION COMPLETE EVACUATE CANNIBALIZE DESTROY ACFT? ACFT? ACFT?

Table 2-1. General Decision Logic

SEE TM 55-1520-328-25

d. General aircraft assessment charts, Table 2-1, guide you through the aircraft's capability so that all the necessary capabilities are evaluated. If a fault is found, Table 2-1 directs you to the chapter for the functional group which contains the fault. The BDAR assessment procedure will refer you

to a guide fix in this manual, a standard TM 55-1520-228-23 repair if it is feasible, or a higher AVIM level of repair if extent of damage, time constraint, tooling requirements, repair part or material, and any other necessary requirements are only available at a higher level of maintenance.

Section II. GENERAL FAULT ASSESSMENT TABLE

2-2. GENERAL FAULT ASSESSMENT TABLE. Refer to Table 2-2 for assessment logic flow chart.

AIRCRAFT IS NOT 100% FULLY MISSION CAPABLE IS THE SYSTEM IN IS ARMAMENT EQUIPMENT WORKING ORDER? NEEDED FOR THE MISSION? YES NO NO YES INSPECT AIRCRAFT FOR GO TO CHPT 18 OBVIOUS DAMAGE WAS AIRCRAFT DAMAGED IS ARMAMENT SYSTEM IN WORKING ORDER? DURING FLIGHT? NO YES NO YES VISUALLY INSPECT FOR ANY DEBRIEF PILOT EXTERNAL DAMAGE TO THE AIRCRAFT IS ANY PART OF THE CONTINUE ASSESSMENT TO STRUCTURE DAMAGED? DETERMINE IF AIRCRAFT GO TO CHPT 4 NO CAN BE USED FOR MISSIONS YES REQUIRING ARMAMENT IS REPAIR DEFERRABLE OR FEASIBLE, GIVEN THE MATERIALS, TIME, AND METHODS AVAILABLE? YES NO | DETERMINE WHETHER THE AIRCRAFT SHOULD BE RECOVERED, CANNI-CONTINUE **NEXT PAGE** BALIZED, OR DESTROYED

Table 2-2. General Assessment

Table 2-2. General Assessment (Cont)

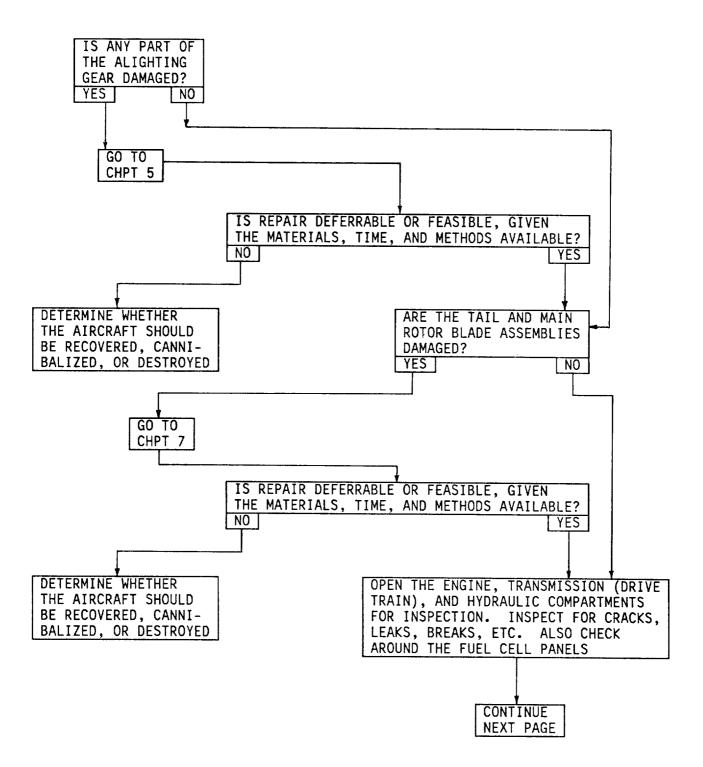


Table 2-2. General Assessment (Cont)

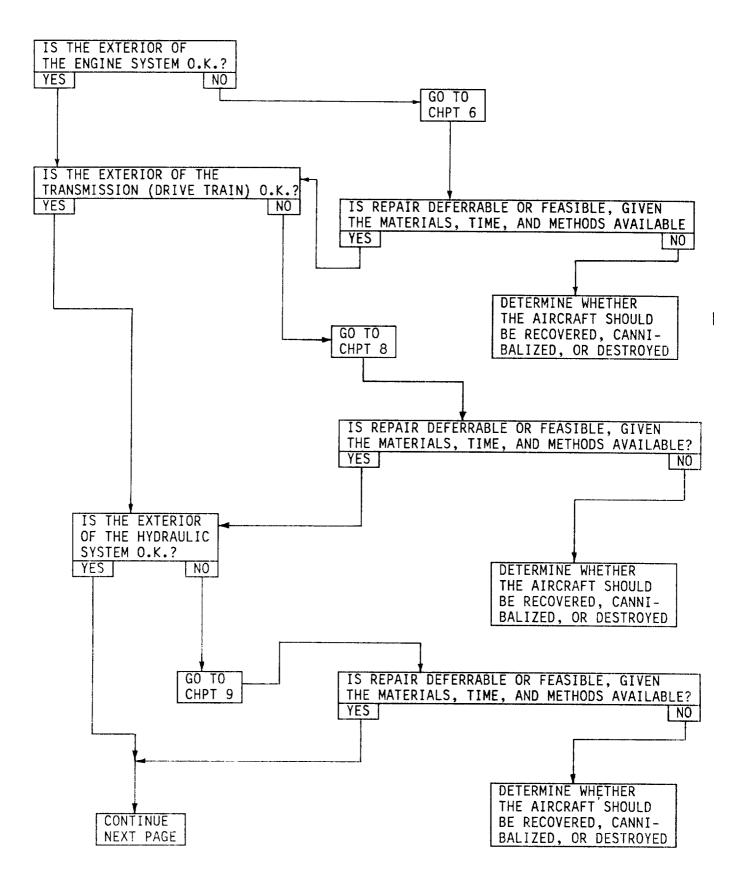


Table 2-2. General Assessment (Cont)

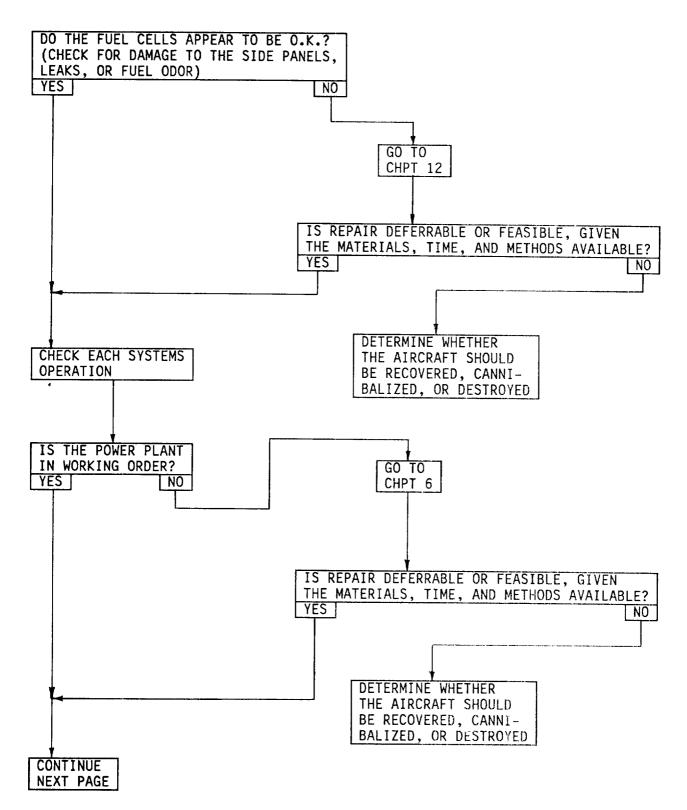


Table 2-2. General Assessment (Cont)

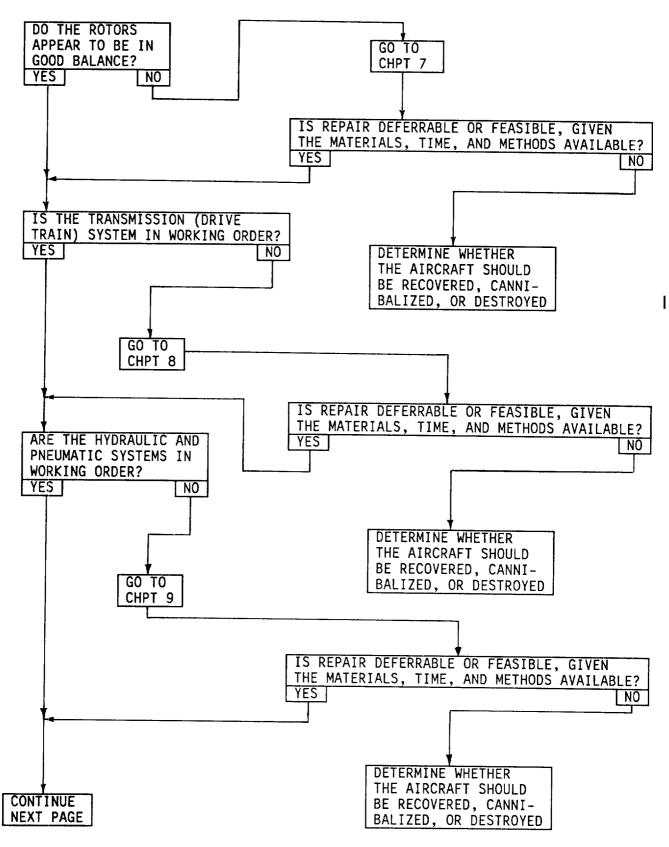


Table 2-2. General Assessment (Cont)

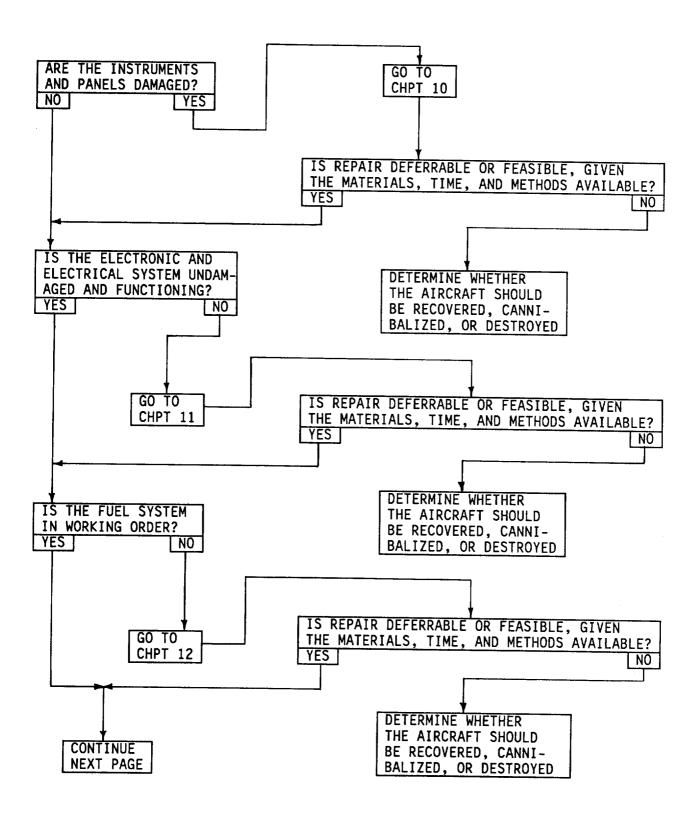
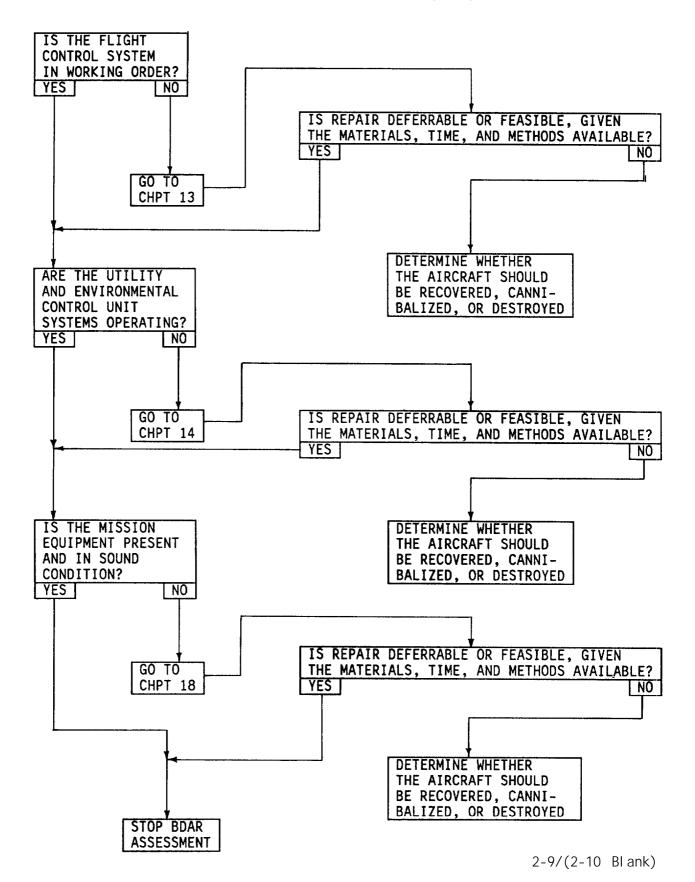


Table 2-2. General Assessment (Cont)



CHAPTER 3

GENERAL REPAIRS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DANAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

No general repairs have been identified Chapters 4 thru 19 for functional group for this model helicopter. Proceed to assessment and repair procedures.

CHAPTER 4

AIRFRAME

BOAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.

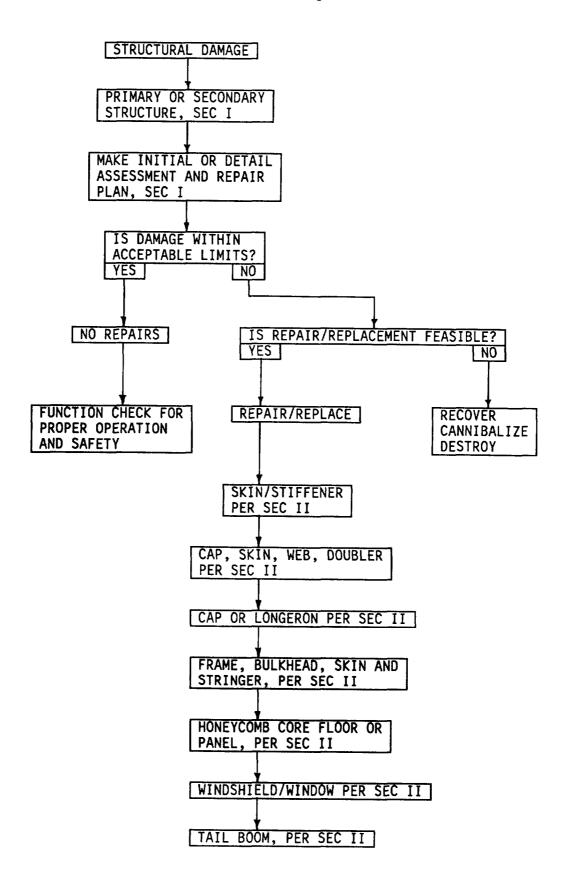
(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

- 4-1. SCOPE. This chapter contains information on battle damage assessment and expedient repair procedures for the OH-58 helicopter airframe. The procedures are to be used only during combat operations or during periods of extreme emergency.
- a. Section I contains information pertaining to the various structural areas which are suspected of being damaged, and whether the damage is to a primary or secondary element. Logic flow chart tables and damage limit tables are also part of this section.
- b. Section II consists of expedient structural repairs and procedures on how to perform these repairs and field fixes.
- **4-2. ASSESSMENT PROCEDURES.** Refer to Table 4-1.
- **4-3. GENERAL.** Aircraft structure is classified as primary and secondary structure.
- a. The primary structure is the basic structure which holds the aircraft together. Any serious damage to any element of the primary structure will restrict the combat capability of the aircraft. The primary structure for each major airframe subassembly is shown in Figure 4-11, Sheets 1 thru 5.
- b. Secondary structures are mounted on the primary structure. No amount of structural damage to secondary structures will restrict combat capability from a structural point of view;

- however, secondary structure may be required for aerodynamic reasons or to accomplish or support mission functions.
- 4-4. STRUCTURAL DAMAGE ASSESSMENT AND REPAIR. The battlefield structural damage assessment and repair consists of three steps: an initial assessment, paragraph 4-5; a detail assessment, paragraph 4-6; and a repair plan, paragraph 4-10. The initial assessment is a quick visual assessment to decide whether or not a detail assessment should be made. A detail assessment involves the identification of all damage to primary structural elements, possibly some clean-up and measurement of the damage and of the damaged elements. The procedure is described for various aircraft sections in this chapter. This process requires damage measurement and determination of the corresponding damage limits. The repair plan is based on an analysis of the detail assessment. An overall view of all the aircraft zones is shown in Figure 4-1.
- 4-5. INITIAL ASSESSMENT. To perform an initial assessment, the assessor must be acquainted with structural damage modes and the primary structure as shown in the figures of this chapter. He shall be capable of differentiating between primary and secondary structure, and he must understand the function of primary structural elements. The initial assessment consists of a visual inspection of primary structure. The assessor determines if any primary caps, webs, or panels are damaged or fractured and decides whether:

Table 4-1. Aircraft Structure Damage Assessment Prodecures



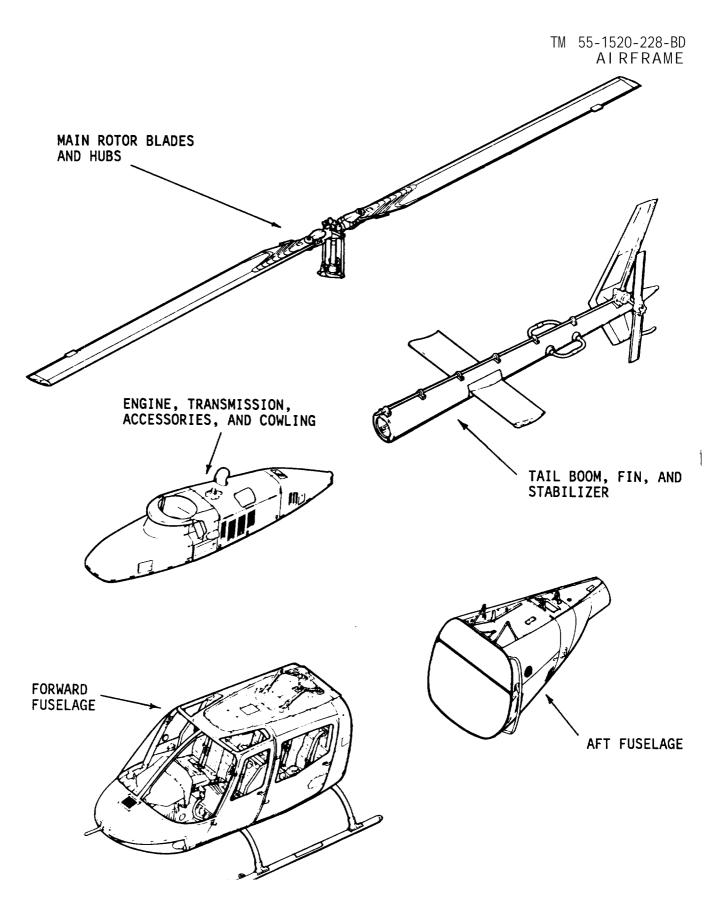


Figure 4-1. Aircraft Sections

- a. the damage appears to be deferrable;
- b. a detail assessment can be made and the damage can be repaired by BDAR techniques within the time available to return the aircraft to service in the ongoing battle;
- c an adequate assessment can be made and the damage can be repaired by BDAR techniques to enable the aircraft to self-recover;
- d. a detail assessment cannot be made and/or the damage cannot be repaired by BDAR techniques within the available time. The aircraft shall be scheduled for standard repair.
- e. The aircraft is damaged beyond repair, and he shall arrange for its disposition (i.e., recovery, cannibalization, or destruction).

4-6. DETAIL ASSESSMENT.

- a. Access to Damaged Structure. Locate all damage to airframe primary structure. Remove access panels, covers, and fairings in the damaged area. Remove aircraft components as required to inspect the structure. Use the location of entrance and exit wounds and the estimates of projectile paths to determine the areas where damage may be present and access to interior inspection will be needed. If an area of structure suspected of being damaged cannot be reached by other means, cut small inspection holes in the exterior skin. Then inspect internal members with an inspection light and mirror.
 - b. Inspecting for Cracks.
- (1) Inspect for cracks caused by impact or penetration in regions away from the site of primary damage.

- (2) Inspect for small and large cracks caused by projectile damage. Small cracks will enlarge under continued loading, particularly when located at the edge of a hole.
- (3) Locate cracks in primary structure using magnifying glass or dye penetrant. Check for cracks around fasteners in areas showing signs of overstress.
- (4) Inspect for cracks in all areas of an explosion caused by a high explosive incendiary (HEI) strike.
 - c. Inspecting for Structural Changes.
- (1) Inspect damaged area and surrounding undamaged area for evidence of buckling, crippling, and misalignment. Kinks, wrinkles, and sheared, pulled-through or missing fasteners on skin panels are indications of structural changes by an HEI hit.
- (2) Inspect structural changes in the form of buckling, crippling, and misalignment caused by overpressure. These structural changes are noticeable in areas where one structural member may have to support the load of another broken member. Check damaged area to see if there is interference with mechanical moving components.
- (3) Use a straight edge to examine the component for twisting or bowing.
- d. Inspecting for Embedded Projectiles and Fragments.
- (1) Inspect for embedded projectiles which can create the same affect as a hole or crack on a tension member.
- (2) Inspect for embedded projectiles and fragments in areas which have suffered HEI damage. The inspection will reveal that a solid projectile is embedded or has broken apart, striking internal components.

- (3) Inspect all structures using bright light and magnifying glass. Determine the path entry of the projectile to aid in finding structures that may have embedded fragments. Mark embedded objects and record them on DA Form 2404, Figure 4-2.
- e. Inspecting for Fire Damage.
 Inspect for fire damage by checking for discoloration of the structure. Any discoloration will Indicate that the member has been exposed to high temperature. Conduct a hardness test to determine if the temperature of the material has changed. If test indicates heat damage, record the information on DA Form 2404 and clearly mark the member.
- f. Detecting Structural Damage in Adjoining Areas.
- (1) Secondary damage can be the result of severe overstress, explosive blast, or maneuvering loads imposed on damaged structures. Inspect the airframe near the projectile damage for evidence of secondary damage.
- (2) Inspect the skin for creases, wrinkles, and dents. Inspect fasteners for chipped or flaked paint, looseness, and serviceability. If these conditions are evident, remove access panels and doors to inspect members for cracks and structural changes.

Inspecting for broken and missing fasteners. Inspect fasteners for security, shear, pull-through, tear-out, and elongated fastener holes. Where possible, inspect fasteners from both sides.

h. Inspecting for Delaminations. Inspect honeycomb structures for voids and delamination using the coin tapping method.

- i. Marking and Recording Damage.
- (1) Record all detected damage. Refer to Table 4-1 for repair/referral of repair on structural member.
- (a) Record name of aircraft section containing the damaged element, Figure 4-1.
- (b) Record the name of the damage element such as frame, stringer, or skin panel.
- (c) Describe the location of the damaged element such as station, waterline, butt line, or panel location.
- (d) Describe the damage to the element using terms such as hole, crack, or buckle.
- (e) Continue damage recording for:
- $\underline{1}$ Other damages to the same element.
- $\underline{2}$ Other damaged elements in the same subassembly.
- <u>3</u>Other damaged subassemblies in the section of the airframe.
- $\underline{4}$ Other damage sections of the airframe as required.
- (f) After the damage inspection is completed, file the damage report in the aircraft log book and make entries as required.
- (2) Damage diagrams. Show the location and extent of damage as shown in the diagrams in Figure 1-3. The damage can be drawn by hand. Accurately locating damage on a diagram will greatly help the damage assessment procedure.

ORG	AHIZATIO	or use of this form	. see TM 38-	750; the propon				Deputy Chief of St	aff for Logistic	:6.
AGG	STRATIO	WERIAL/NEN	44 MICES	b. HOURE	r. #0	UNOS d.	HOT STARTS	E. DATE	B. 7V	PE INSPECTIO
M NUI						REFEREN				
M NUI	W0EK]	M DATE	į	TM NUM	HR		TM C	ATE
COL	UMN 6 -	Enter TM item r Enter the applic	able condit	-	nboi.	COL	oming lli JMN • —	Show corrective sted in Column c. Individual accert		-
COL	UMN c	Enter dessciencie	s and shor			YMBOLE		this column.		
CIRC mer dire	LED "X" nt may be ected by h	a deficiency in trable status. —indicates a defoperated under igher authority or action can be	lciency, ho specific lim or as prescr	ent that place wever, the equitations as ibed locally,	•	DIAG than cres serv	ONAL " a deficie ne deficie iceable. NAME I	(/)'-Indicates a sency which must sency or to make sency	be corrected the item com CK, BLUE-B	to in- plotely LACK INK
		DASH "(-)"—ii ent replacement				con-	dition exi	isto.		
or t	est flight i	s due but has no has not been as	t been acco	omplished, or		FOR	AIRCRA	FT-Status symbo	is will be rec	orded in red.
	ALL INSP	ECTIONS AND	EQUIPME	NT CONDITI	IONS RE	CORDE	D ON TH	IS FORM HAVE S IN THE TM CI	BEEN DET	ERMINED
		rson (s) performing						ce Supervioor)	96. TIME	10.MANHO
										AEGO!A
TM TEM	STATUS	DEFICIENC	IES AND S	HORTCOMING	•		cor	RECTIVE ACTIO	<u> </u>	INITIAL
NO.										CORRECT
										ļ
	1									
										
	 									
	<u> </u>								·	
								····		
	 									
	 		· 	·						_
		· · · · · · · · · · · · · · · · · · ·						·-··		
										1
								·		+
	 									
										
_	1				Ţ	_				
										
	1									

Figure 4-2. DA Form 2404

(3) Marking damage. Mark the damaged structure using grease pencil or paint. Use the labeling scheme shown in Figure 1-3.

CAUTION

Use of lead pencil in some areas will cause corrosion.

- (a) Uses bright color to outline each area of damage as it is located and recorded on the DA Form 2404. Attempt to make the outline visible from all angles.
- (b) Draw arrows on inside skin panels, webs, and bulkheads to point toward areas of damage that are hidden.
- DAMAGE MEASUREMENT. If the assessment indicates that the damage should be repaired by BDAR or standard procedures, no damage measurement is necessary. Damage measurement is required to determine if structural repair (other than cleanup) can be deferred, or if self-recovery of the damaged aircraft is feasible. Damage measurement may also be required if a BDAR repair does not restore original strength. Begin damage measurement with the largest damage.
- a. Damage Measurement of Typical Sections.
- (1) The parameters involved in measuring damage to typical sections are shown in Figure 4-3. The pertinent values are:

CD = Depth of damage.

CL = Length (width) of damage.

 $A = CL \times CD = area of damage.$

D = Distance between damages.

In Figure 4-4, the length of the flattened cross section of the angle is:

CD is the depth of the damage into the flattened cross section. The length of the remaining effective cross section is still capable of supporting a load. All dimensions are in inches.

$$CS = (a+b)-CD$$

- (2) When measuring damage, use the following procedure:
- (a) Clean all damaged areas thoroughly. Use brushes and swabs to remove dirt and film from small crevices where damage may be present.
- (b) Smooth all jagged and rough edges and be sure to cut out all radiated cracks. Use largest corner radii possible in the cut-outs; avoid sharp corners.
- (c) Measure damage after smoothing, or if measuring before smoothing, make allowance for the material which must be removed during smoothing. See paragraph (d) below.
- (d) Use a steel rule graduated in tenths of an inch and measure each damage dimension to the next higher tenth.
- (e) Include the size of the hole when measuring damage that extends into a fastener hole or lightening hole.
 - (f) Record on DA Form 2404.
 - Webs, Panels, and Skins.
- (1) Refer to Figures 4-5 and 4-6 for the measurements of "WL" and "D." "WL" is the largest dimension across the damage, regardless of direction, and must include all radiated cracks. is the distance between damages. Take and record measurements as described in paragraph 4-7.a(2).

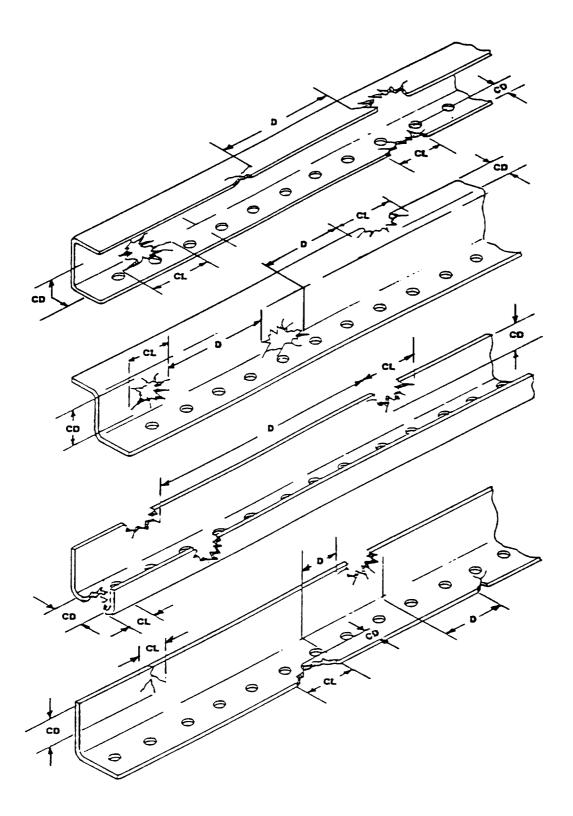
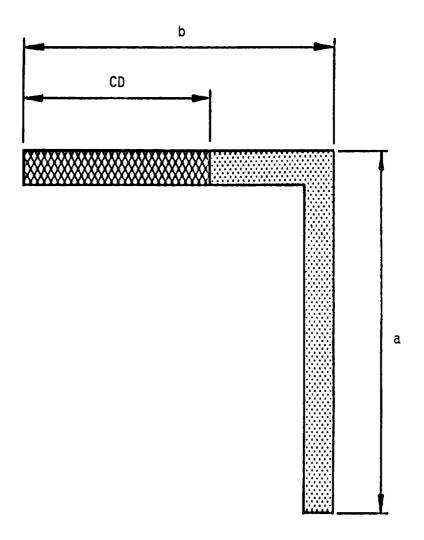


Figure 4-3. Evaluating Damage to Angles, Channels, and Z-Angles



Remaining Area of Flattened Cross Section:

Damaged Area of Flattened Cross Section:

Figure 4-4. Damaged Cross Section

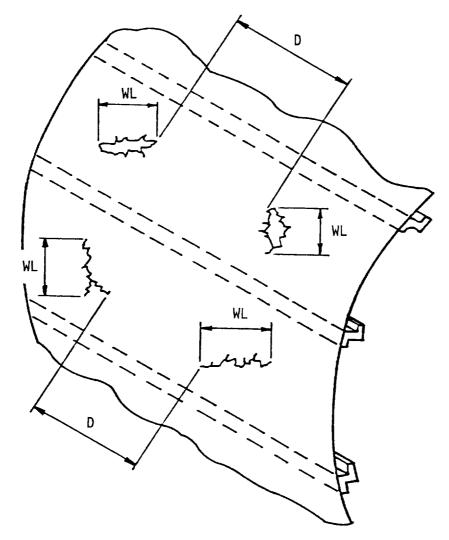


Figure 4-5. Measuring Skin Panel Damage

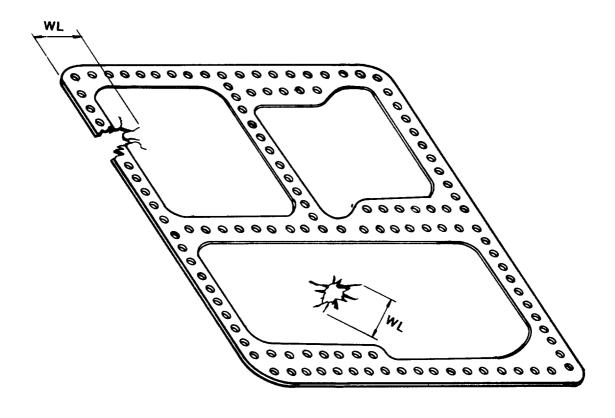


Figure 4-6. Measuring Damage in Webs and Panels

TM 55-I 520-228-BD AI RFRAME

- (2) Honeycomb Sandwich Structures. Refer to Figure 4-7 for the measurement of "WL" and "D." If a projectile hits a sandwich panel at an angle, the damages in the two skins may be off-set and of different sizes. Measure the damage on the side with the largest damage (usually the exit side), and make sure that the measurement includes the damaged area on the other side. "WL" is the largest dimension across the damage (both sides), regardless of direction, and must include all radiated cracks. "D" is the distance between damages. Take and record the measurements as described in paragraph 4-7a(2).
- c. Fittings, Attachments, and Splices.
 - (1) See paragraph 4-12.
- (2) Record all damage on DA Form 2404, Figure 4-2.
- d. Damage measurements apply after cleanup and smoothing or after BDAR has been accomplished. However, as a practical matter, measurements must be taken before smoothing to make a decision on deferrability. Hence, when estimating damage limits before cleanup and smoothing, make allowance for the material that will be removed in smoothing. This applies particularly to cracks. The length of the crack must be included in in the depth (CD) and length (CL) measurements.

4-8. ALLOWABLE DAMAGE LIMITS DEFINITION.

a. The allowable damage limits corresponding to the damage measurements of paragraph 4-7 are designated for a given condition as follows:

CD' = Allowable depth of damage.

CL' = Allowable length (width) of damage.

A' = Allowable area of damage.

D' = Minimum allowable distance between damages.

WL' = Allowable largest dimension across web/panel damage.

N = Minimum damage factor.

- b. Allowable damage limits for primary structural elements are associated with the conditions of paragraph 4-9. A damage limit for a given condition is a measure of the amount of damage that a structural member can sustain and still support the loads associated with the given condition.
- c. For a given condition, all damages must be equal to or less than the corresponding allowable damage limits, and the distance between damages must be equal to or greater than the corresponding minimal allowable limit; that is:

CD < CD' WL < WL' D > D'

The aircraft may be released for flight in that condition. Repair may be deferred, although some cleanup and smoothing of the damage will be required, as will Inspection for damage growth after every flight. Special consideration should be given to damage exposed to the airstream, particularly to the effects of ram air, rain, and petaling. Petals may vibrate in the passing airflow, rapidly creating cracks in the supporting base metal. Large pieces of metal may peel off and damage other parts of the aircraft. The distance D between damage sites for most structures has a minimum required The spacing requirement is expressed as a multiple factor (N) of the measured area of damage.

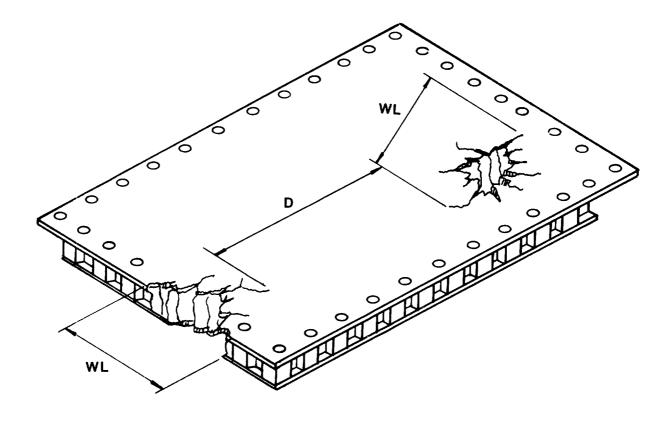


Figure 4-7. Measuring Damage in Honeycomb Sandwich Panels

- (1) The factor applies to the damage actually measured not to the maximum damage limit for the structure.
- (2) The factor applies to the largest dimension of the largest damage between which separation is being measured.
- (3) The factor applies only if the dimensions of both damages, when added together, exceed the single damage limit.
- 4-9. CONDITION. Condition is an indicator of the residual capacity of a damaged structural element to perform its function. Battlefield damaged structures or BDAR repaired structures are classified in three conditions:
- a. Condition 1. Aircraft fully flight capable. No flight restrictions. However, on a battlefield under the pressures of time and tactical situations, the assessment of structural damage may not have found all the damages. Therefore, aircraft with structural damage, whether repaired or repair deferred, should be inspected after every flight. The inspector should look for crack growth, evidence of overstress, growth of allowable deformations, and for the development of new cracks at other locations.
- b. Condition 2. Self-recovery capable. Self-recovery may be required to move a damaged aircraft to a repair site or from one site to another when towing is not feasible. Self-recovery is preferable to disassembly and boxing an aircraft for transportation. As time permits, proceed as follows:
- (1) Mark all visible cracks and the extent of other structural damage with chalk, grease pencil, paint, tape, or other available means so that any growth in the damage can be quickly recognized.

- (2) Perform any feasible on-site BDAR fixes as required for self-recovery.
- (3) Unload all ammunition, weapons, stores, and unnecessary equipment.
- (4) The following restrictions are imposed on a recovery flight:
 - (a) Maximum airspeed: 50 kts
 - (b) Maximum engine torque:

80% at 0 kts 64% at 16 kts 53% at 32 kts 50% at 50 kts

- (c) Maximum flight time:
- 2 hours.
- (d) Use gradual and smooth pedal movements to minimize loads on aircraft.
- (e) Land at level attitude; soft touchdown from hover.
- c. Condition 3. Structural damage exceeding condition 2 limits generally does not allow self-recovery. The damage may or may not be repairable by BDAR techniques. The airframe may be so extensively damaged that no useful or needed functions can be restored within available time and resources. These aircraft will be:
- (1) Recovered or evacuated to a facility with the resources to repair the airframe.
- (2) Used as a source of cannibal-ized components.
- (3) Destroyed. This is a last resort. These conditions apply to the primary structure and should not be confused with the mission capability classifications. Mission capability is dependent on equipment condition.

- d. The type, extent, and variation of damage under condition 3 does not permit categorization of the many combinations of damage. Self-recovery, if considered, will depend on the extent and type of damage, type of terrain, distance, and urgency of the situation.
- If judgment and experience indicate self-recovery is feasible, it should be accomplished at minimum weight, altitude and airspeed with an occasional stop to check on the condition of the aircraft.

4-10. REPAIR PLAN.

- a. The damage measurements and initial repair data obtained from the detail assessment must be organized and formulated into a repair plan.
- b. Repair requirements including cleanup/smoothing, condition, and repair times should be recorded on DA Form 2404.
- c. If the worst case is better than condition 1, repair may be deferred except for cleanup and smoothing of all rough edges. The ends of all cracks must be stop drilled.
- d. If the worst case is between condition 1 and 2, a decision must be made to degrade the aircraft to condition 2 or to repair the aircraft and restore it to condition 1.
- (1) If the aircraft is degraded to condition 2 and is to perform a recovery flight, severe damage should be cleaned-up, rough edges smoothed, and cracks stop drilled.
- (2) If it is decided to restore the aircraft to condition 1,
- (a) determine the required repairs for all damaged structural elements that are below condition 1.

- (b) Repairs on damaged structural elements that are better than condition 1 may be deferred except for cleanup and smoothing.
- e. If the worst case is between condition 2 and 3, a decision must be made to degrade the aircraft to condition 3 or to repair the aircraft and restore it either to condition 1 or 2. An aircraft in this condition is probably so badly damaged that it may not be restored to condition 1 within the available time. However, every effort should be made to restore it to condition 2 or better if at all possible for recovery.
- (1) If the aircraft is degraded to condition 3, no repair is required.
- (2) If it is decided to restore the aircraft to condition 2,
- (a) determine the required repairs for all damaged structured elements that are below condition 2.
- (b) Repairs on damaged structural elements that are better than condition 2 may be deferred except for some cleanup and smoothing of the badly damaged areas.
- (3) If it is decided to restore the aircraft to condition 1,
- (a) determine the required repairs for all structural elements that are below condition 1.
- (b) Repairs on damaged structural elements that are better than condition 1 may be deferred except for cleanup and smoothing.
- f. Once all decisions are made and a repair plan formulated, complete repairs. Attach DA Form 2404 to DA Form 2408-13 and indicate deferred repairs on DA Form 2408-13.

4-11. GENERAL.

- a. The aircraft consists of three main sections. The forward cabin section extends from the cockpit nose at FS1 to the bulkhead aft of the passenger compartment at FS130. The aft cabin section extends from FS130 to FS205 where the tail boom is attached. The third section is the tail boom. Refer to Figure 4-8.
- The forward section utilizes aluminum honeycomb and sheet metal structures for the major load carrying elements. The forward section provides for pilot and passenger seating, fuel cell enclosure, and pylon support. Honeycomb sandwich is used extensively in this section, including the upper and lower shells, seat panels, and some bulkhead panels. The remainder is of conventional thin sheet metal construc-Primary loads forward of FS73 are taken by the lower console, pedestal, and lower shell. The cabin enclosure section between FS73 and FS130 is a X -Z planar frame consisting of the center post at FS73, roof beam, lower shell, and bulkhead ant{ enclosure at FS114 and FS130. Refer to Figure 4-9.
- c. The aft section utilizes an aluminum and honeycomb semimonocoque construction and provides a deck for engine installation and a compartment under the engine deck for electrical equipment. This section utilizes conventional thin sheet metal structure composed of longerons and bulkhead frames as beam elements and decks and skins as shear panels. Some of the fairing and decks are honeycomb panels.
- d. The tail boom is a circular section with a horizontal stabilizer, vertical fin, and anti-torque rotor attached. The tail boom is a full monocoque structure utilizing a tapered circular section of aluminum alloy skin. Redistribution in the forward end, which is required to transfer loads from the

- monocoque structure to the four attachment fittings on the fuselage, is accomplished by the use of intercoastals and two aluminum redistribution bulkheads. The horizontal stabilizer is a standard spar-rib-skin riveted construction. The vertical fin is of standard sandwich construction using aluminum honeycomb core and thin aluminum skins. The upper half of the upper fin is composed of fiberglass skins and honeycomb core.
- e. The damage assessment procedure described in paragraph 4-5 consists of damage measurement, determination of the corresponding allowable damage limit and associated condition, and formulating repair instructions. This data is recorded on DA Form 2404.

4-12. DAMAGE MEASUREMENT.

- a. Refer to Figures 4-8 thru 4-15 for location and identification of major fuselage and tail boom structural areas.
- Refer to paragraph 4-8 and for each damaged element, measure the depth "CD" and the length (width) "CL" or "WL" of each damage. Count the number of damages and measure the "D" between Start with the worst damage. Record these values for each damaged element on DA 2404 and compare them with the allowable damage limits given in this section. Select the set of allowable damage limits which are next larger than the measured damage, determine the corresponding condition. Consider whether damage could result in flight failure of other elements. Attempt to visualize what effect large defections of damaged member will have on adjacent structure.
- c. Decide on whether repair can be deferred or whether damage should be fixed and what the condition of deferred or repaired damage would be.

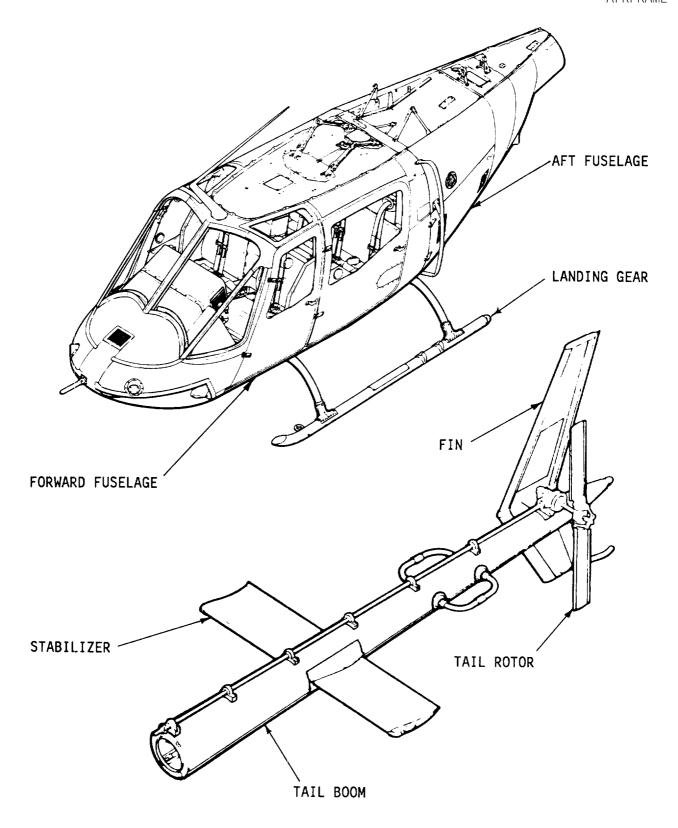
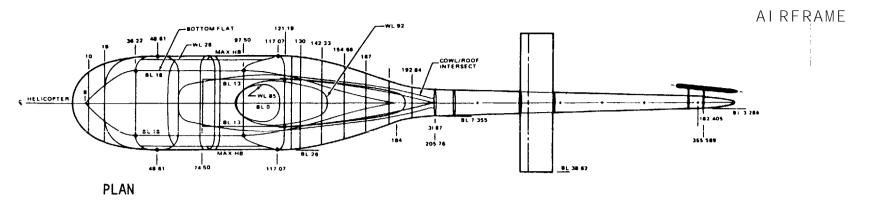
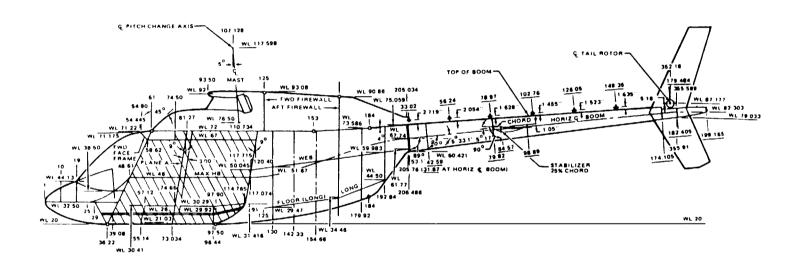


Figure 4-8. OH-58 Helicopter





PROFI LE

BL - BUTT LINE

FS - FUSELAGE STATION

WL - WATERLINE

BS - BOOM STATION (UNDERLINED)

📤 CENTER TAILROTOR BEARING HANGER.

TANGENCY POINT.
CONTOURS IN BOOM STATIONS ARE
CIRCLES. RADIUS AT 31.87 IS 7.3555"
RADIUS AT 182.405 IS 3.286". TAPER'
OF BOOM IS 0.02703" PER INCH. BOOM
STATION IS 90° TO HORIZ C BOOM.

Figure 4-9. Airframe Reference Lines

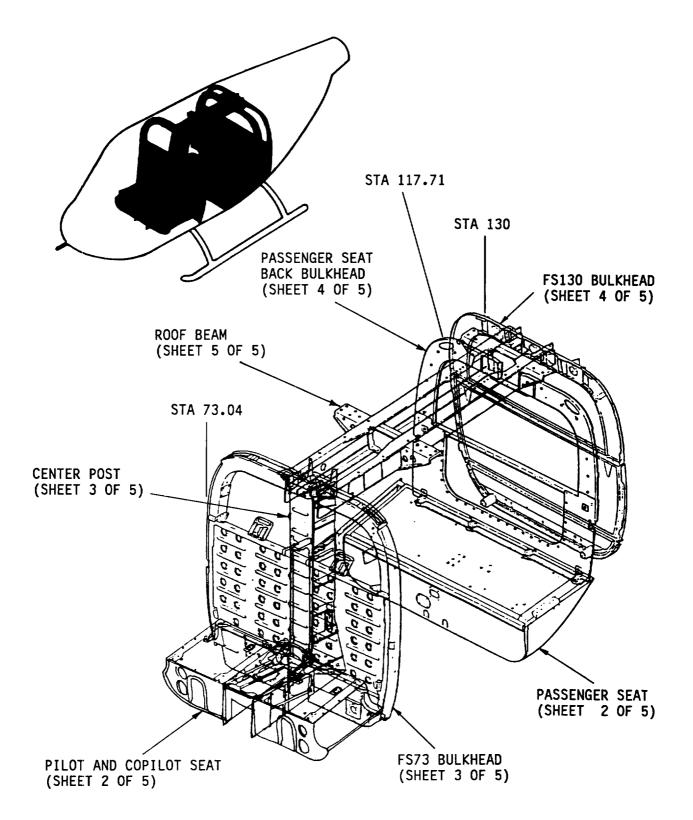
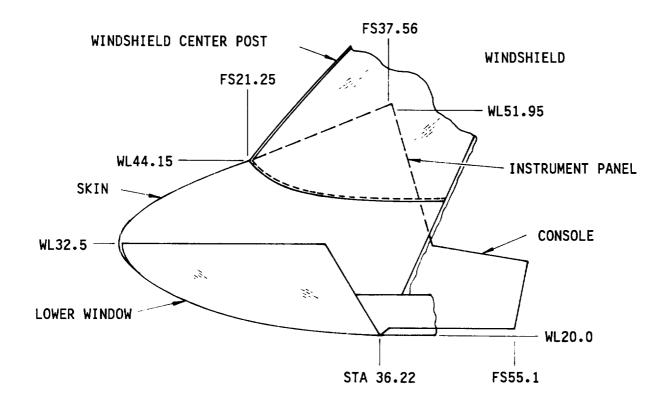


Figure 4-10. Cockpit



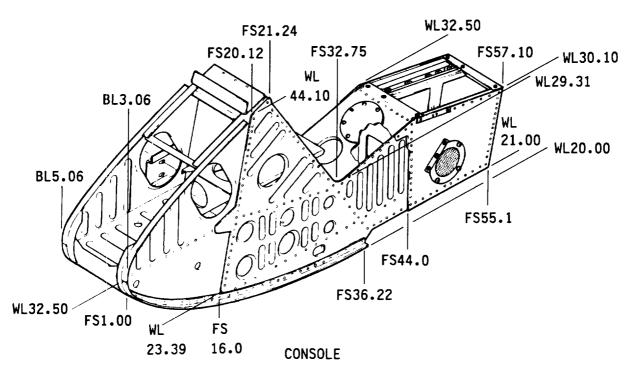
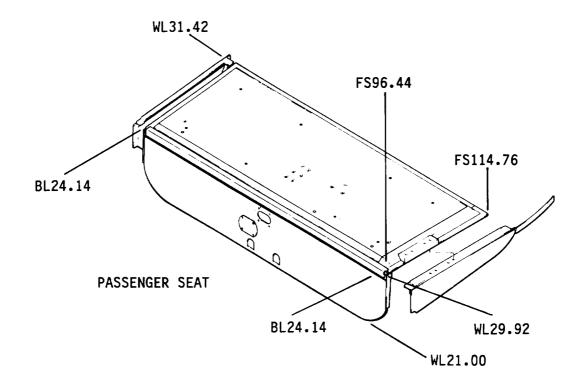


Figure 4-11. Fuselage Pylon Support Structure (Sheet 1 of 5)



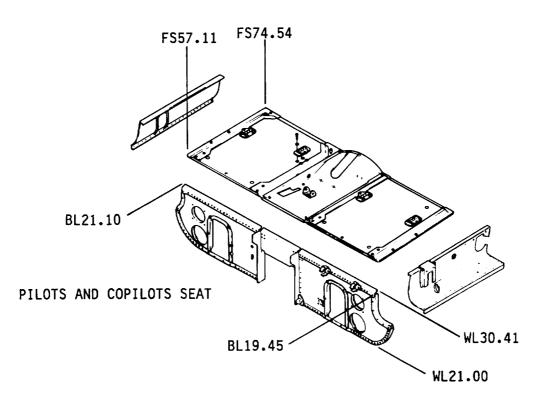


Figure 4-11. Fuselage Pylon Support Structure (Sheet 2 of 5)

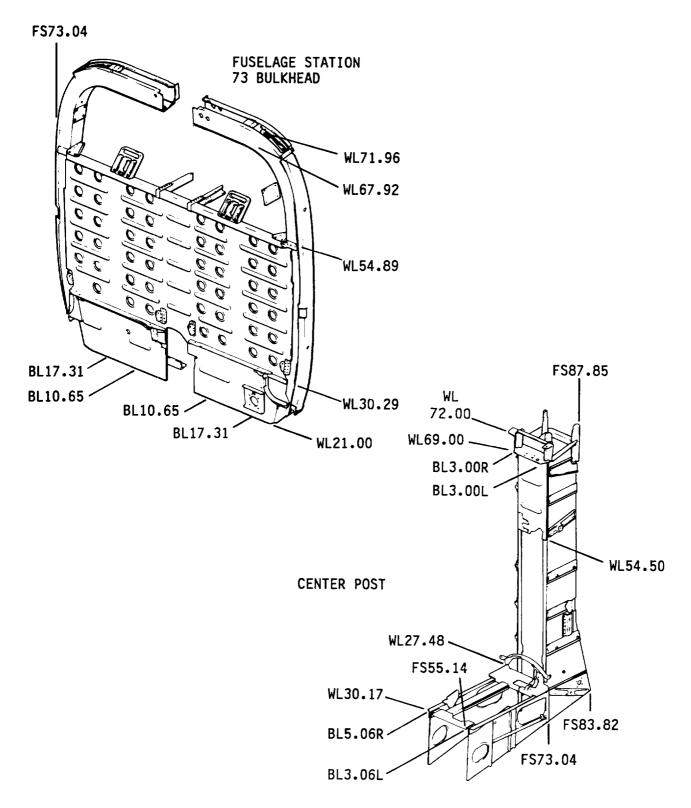


Figure 4-11. Fuselage Pylon Support Structure (Sheet 3 of 5)

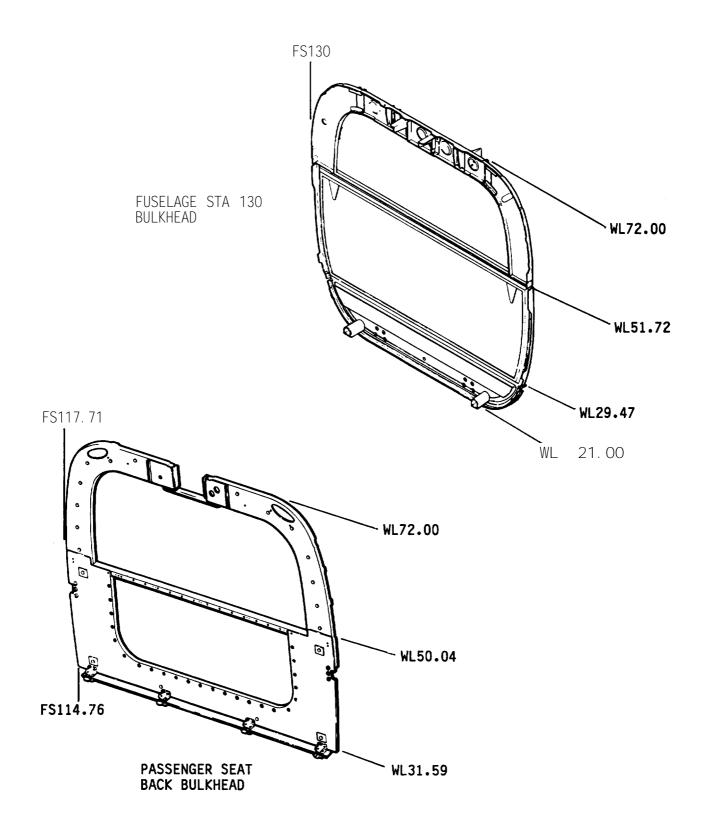
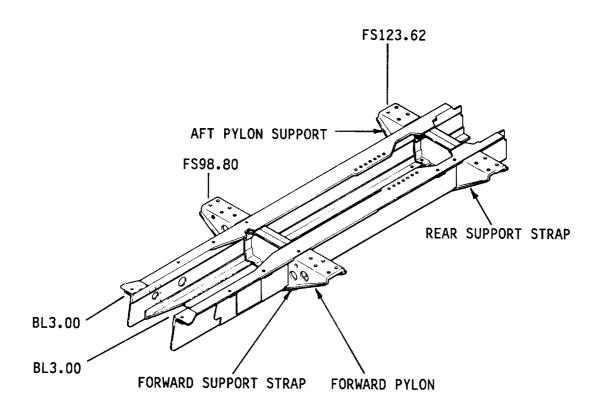
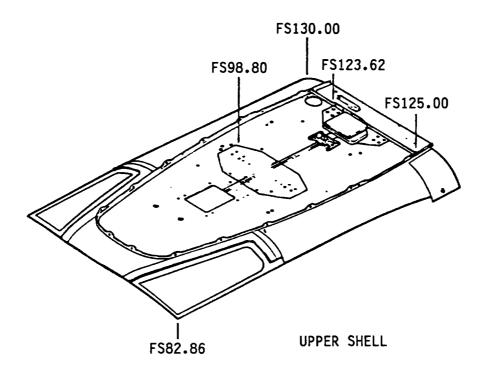


Figure 4-11. Fuselage Pylon Support Structure (Sheet 4 of 5)



ROOF BEAM

Figure 4-11. Fuselage Pylon Support Structure (Sheet 5 of 5)



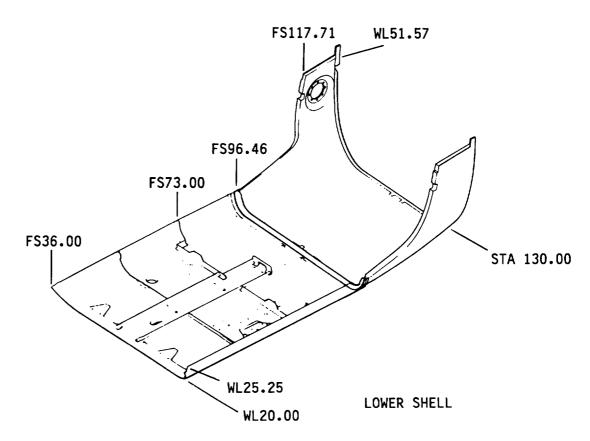


Figure 4-12. Upper and Lower Shell Structure

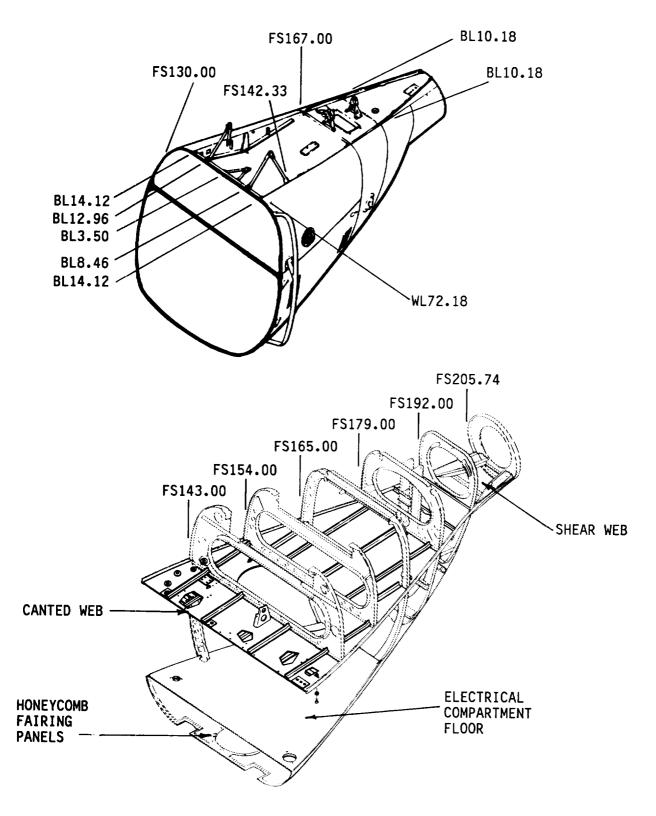
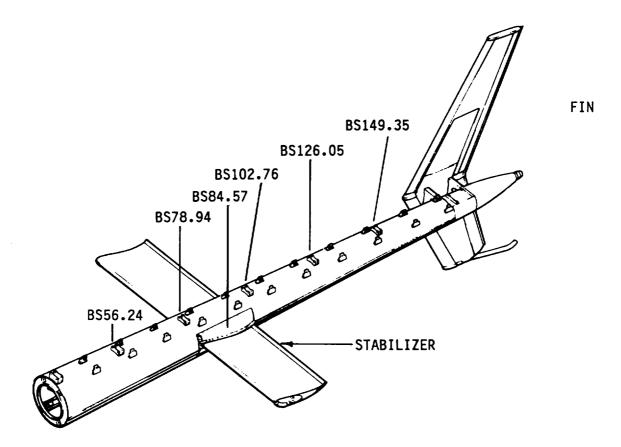


Figure 4-13. Aft Fuselage Structure



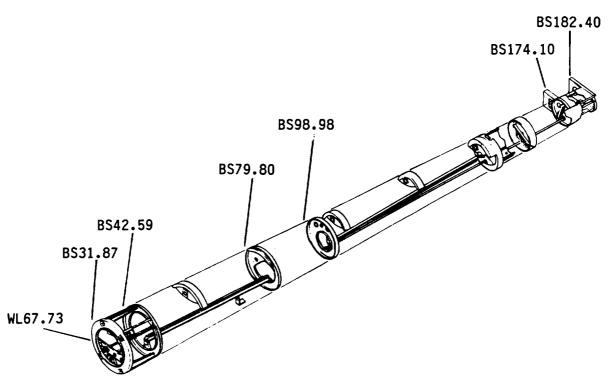


Figure 4-14. Tail Boom

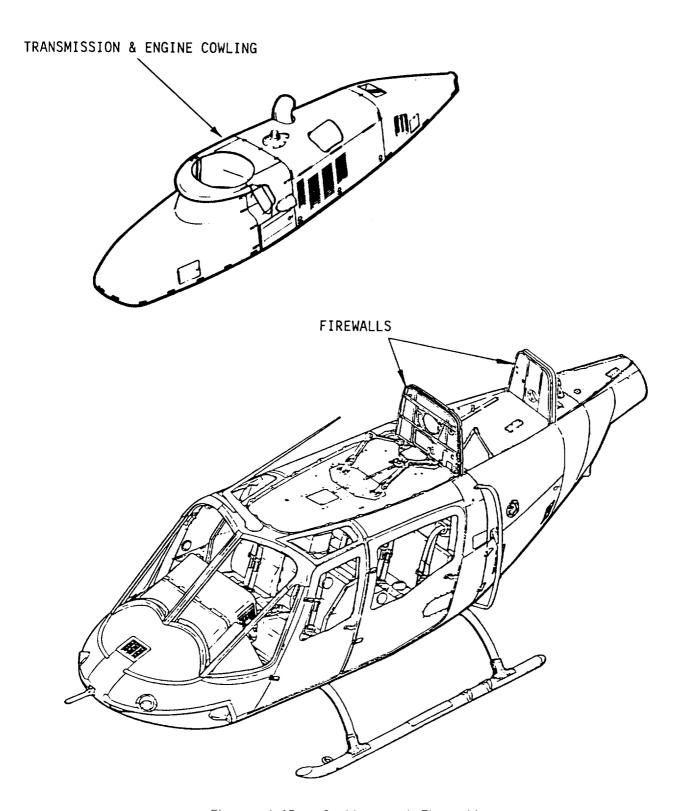


Figure 4-15. Cowling and Firewalls

- d. Determine the priority of the various required repairs based on repair time, difficulty of repair, resources available, tactical situation, and need for the aircraft, etc. The longest repair time normally is given the highest priority and is most critical.
- 4-13. ALLOWABLE DAMAGE LIMITS. Damage limits are calculated on the basis of the OH-58 structural analysis and tend to be conservative. Assessors using damage limits to prepare damage assessments should consider them as guides and balance the damage limits against the judgment resulting from their own experience.
- a. Damage limits are tabulated in Tables 4-2 thru 4-7 for most primary structure. If a damaged member is not covered in this manual and the damage appears to exceed authorized limits, classify the member as unserviceable.
- b. A component that shows signs of severe overstress such as twisting or buckling or heat damage should be treated as failed.
- c. A component should be repaired if the failed component can overstress other systems.
- d. <u>Evaluation of Damage to Caps.</u>
 <u>Longerons, and Stringers.</u> Classify
 caps, longerons, and stringers as failed
 if any of-the following conditions
 exist:
- (1) Damage exceeds limits tabulated in Tables 4-2 thru 4-7.
- (2) There is damage in four or more locations within a length of three feet.
- (3) Fasteners securing the component to other major components are sheared, pulled-through, or missing at one or more locations.

- (4) Three or more fasteners next to each other, which join a cap, longeron, and stringer to the web, are sheared, pulled-through or missing.
- (5) Twenty percent or more of the component to web fasteners are similarly damaged.
- (6) Angles and clips securing the component to another structure are severely damaged or failed.
- e. <u>Evaluation of Damage to Machined</u> <u>Fittings.</u> Classify a fitting as failed if any of the following conditions exist:
- (1) Damage to the fitting exceeds the limits contained in Tables 4-2 thru 4-7, or if damage is not tabulated and exceeds 20 percent of the structural section in any one location.
- (2) One or more fasteners connetting the fitting to a structure or to an aircraft component are bent, sheared, stripped, or loose.
- f. Evaluation of Splices, Straps, Doublers, and Gussets. Damage to a splice, strap, doubler, and gusset will be evaluated as part of the elements to which it attaches. Classify a splice, strap, doubler, or gusset as failed if any of the following conditions exist:
- (1) Damage exceeds the limits contained in Tables 4-2 thru 4-7, or if damage is not tabulated and exceeds 20 percent of the structural section in any location.
- (2) The part has significant damage at the intersection of the two members it connects.
- (3) Fasteners securing the part to a structural member(s) are sheared, pulled-through, or missing at two or more adjoining locations.
- (4) More than 20 percent of the total number of fasteners are similarly damaged.

- g. <u>Evaluation of Damage to Skin and Web Panels</u>. Classify a skin or web panel as failed if any of the following conditions exist:
- (1) Damage exceeds the limits contained in Tables 4-2 thru 4-7, or if damage is not tabulated and exceeds 25 percent of the panel area.
- (2) Damage to one panel is located within 3 inches of damage in an adjoining panel.
- (3) The panel is severely deformed or buckled.
- (4) Damage to a panel exceeds the damage limit. The damage extends across a stringer, frame, or former in an adjoining panel. Classify that panel as failed even if its damage is within limits.
- (5) The panel is on the outside of the aircraft where the damage is exposed to aerodynamic forces that can produce peeling or tearing of the structure in flight.
- (6) Fasteners securing the panel are sheared, pulled-through, or missing at three or more adjoining locations.
- (7) Twenty percent or more of the total number of fasteners are similarly damaged.
- h. <u>Evaluaton of Damage to Honeycomb-Sandwich Panels.</u> Classify a honeycomb-sandwich structure as failed if any of the following conditions exist:
- (1) Damage exceeds limits tabulated in Tables 4-2 thru 4-7.
- (2) The panel is damaged to the extent that it cannot support the weight of personnel, cargo, or equipment for which it was designed.
- (3) The panel is on the outside of the aircraft where it is exposed to aerodynamic forces, and the damage is

- oriented so as to produce peeling or tearing of the structure in flight.
- (4) The panel is secured by mechanical fasteners. Three or more adjoining fasteners are sheared, pulled-through, or missing.
- (5) Twenty percent or more of the total number of fasteners are similarly damaged.
- i. Evaluation of Damage to Sheet Metal Ribs, Formers, Intercoastals, and Channels. Classify a rib, former, intercostal, or channel as failed if any of the following conditions exist:
- (1) Damage exceeds the limits contained in Tables 4-2 thru 4-7, or if damage is not tabulated and exceeds 25 percent of the structural section.
- (2) Fasteners securing the component are sheared, pulled-through, or missing in three or more adjoining locations.
- (3) More than 20 percent of the total number of fasteners are similarly damaged.
- j. <u>Evaluation and Damage to Hatches, Doors, and Door Jambs.</u> Classify a damaged hatch, door, or door jamb as failed if any of the following conditions exist:
- (1) Damage exceeds limits tabulated Tables 4-2 thru 4-7.
- (2) Damage to the hatch, door, or door jamb prevents it from being secured adequately to the airframe.
- (3) Hinges and latches are damaged and in danger of becoming unserviceable in flight.
- (4) The hatch or door shows signs of severe overstress such as buckling or misalignment.

Table 4-2.	Damage	Li mi ts	Forward	Fusel age	-	Condition I	
------------	--------	----------	---------	-----------	---	-------------	--

	Tabl C 4-2. Dai		1	DAMAGE LIMITS			
COMPONENT/	LOCATI ON		ELEMENT	CAP/FLANGE			
	FS	LUCATION W	BL		CD' CL' N	M , N	NOTES/CAUTIONS
MEMBER			5. 06R-	Caps, Stiffeners,	(D' =NXCL)	$(D' = N \times WL)$	NOTES/ CAUTTONS
Consol e,	1.00-	20. 00-				(D =NXWL)	
Forward	32. 75	44. 50	3. 06L	Doubl ers	1.05 2.10 10		
	1. 00-	20. 00-	5. 06R-				
	32. 75	44. 50	3. 06L	Ski ns/Webs		2.5 5	
	32. 75-	21. 00-	5. 06R-	Caps, Stiffeners,			
	55. 10	32. 50	3. 06L	Doubl ers	0. 15 0. 30 10		
	32. 75-	23. 39-	5. 06R-				
	44.00	32. 50	3. 06L	Ski ns/Webs		2.5 5	
	32. 75-	21. 00-	5. 06R-			No Damage	
	44.00	23. 39	3. 06L	Skin		Allowed	
Honeycomb	44. 00-	21. 00-	5. 06R-				
Panel	57. 10	32. 50	3. 06L	Honeycomb Panel	•	7.505	
	44.00-	21. 00-	5. 06R-	,			
	57. 10	32. 50	3. 06L	Panel Edges	0. 20 0. 40 10		
Instrument	071.0	02.00					
Panel	21. 25-	44. 15-	5. 02R-				
Shroud	37. 57	51. 95	3. 02L	Brace	1. 25 2. 50 10		
Front	07.07	01.70	0. 02L	B1 400	1. 20 2. 00 10		
Seat		21. 00-		Honeycomb		No Damage	
Support	57. 11	30. 41		Bul khead		Al I owed	
Pilot's &	37.11	30.41		Dai Kricaa		ALLOWCU	
Copilot's	57. 11-		19. 45L-				
		30. 41	19. 45L- 22. 15R	Honeycomb Panel		3. 5 5	
Seat	74. 54	30. 41	22. TOR	noneycollo Parier		3. 3 3	
Center		30. 29-					
Bul khead	70.04			Wob		10 0 F	Dobind Dilata
Secti on	73. 04	54. 89		Web		10.0 5	Behind Pilots
Center		01 00	10 / 5	Mainti and			C E D
Bul khead	70 0.	21. 00-	10.65-	Vertical			Sum of Damage
Section Section	73. 04	30. 29	17. 31L&R	Sti ffeners	2.0 4.0 -		on All Elements
Pilot's &				Aft Attachment			
Copilot's	73. 04	30. 29		Angl e	No Damage Pe	rmitted	
Collective		21. 00-		Support Bracket			
Jackshaft	73. 04	30. 29		Channel	0. 70 1. 50 10		
Pedestal	55. 14-	20. 00-	5. 06R-				
Structure	73. 04	30. 17	3. 06L	Webs		0.755	

Table 4-2. Damage Limits Forward Fuselage - Condition I (Cont)

		<u>lable 4-2</u>	<u>. Damage L</u>	<u>imits forward fusela</u>	age - Condition i	(Cont)	
COMPONENT/	FS	LOCATION WL	BL	ELEMENT	DAMAGE LI CAP/FLANGE CD' CL' N	MITS SKIN/WEB WL'N	NOTES/CAUTI ONS
MEMBER	F3	VV L	DL				NOTES/ CAUTTONS
Pedestal	55. 14 <i>-</i> 73. 04	20. 00- 30. 17	5. 06R- 3. 06L	Caps/Stiffeners	(D' =NxCL) O. 65 1. 30 10	(D' =NxWL)	
Structure	73.04		J. UUL	Caps/Stritellers	0.03 1.30 10		
Lower Shell	36. 00- 73. 04	20. 00- 25. 25		Honeycomb Panel	N. D. W. I.	3. 50 5	
	36. 00- 73. 04	20. 00		Inserts for Cyclic & Pedal Controls	of Insert		
	73. 00	20. 00	12. 16& 14. 58L&R	Forward Landing Gear Attachments	One Damaged Permitted	Insert	
Center Post	73. 00- 87. 85	20. 00- 72. 00	3. 00L- 3. 00R	Caps	0. 25 0. 50 10		
	73. 00- 87. 85	27. 48- 72. 00 54. 50-	3. 00L- 3. 00R	Side Webs and Doublers		2. 25 5	
	74. 52- 81. 30	72. 00	3. 00L- 3. 00R	Web, Front		0 -	
	80. 00- 87. 85	62. 00-	3. 00L- 3. 00R	Splices	0		
	73. 00- 87. 85	72. 00 20. 00- 72. 00	3. 00L- 3. 00R	Stiffeners	0.50 1.00 10		
Passenger Seat	96. 44- 114. 76	29. 92- 31. 42	24. 14L- 24. 14R	Honeycomb Seat Panel		4. 25 5	No Damage Within 3" of Gun Mounts (If used)
	96. 44 <i>-</i> 114. 76	24. 70- 29. 92	23. 08L&R	Honeycomb Side Panels		1.5 5	
	96. 44	20. 00- 29. 92	23. 08L- 23. 08R	Honeycomb Front Panel		4.0 5	
	96. 44- 114. 76	20. 00- 29. 92	23. 08L- 23. 08R	Angles, Side, Front Top, Bottom	0. 25 0. 50 10		
Gun Mounts	103. 76	30. 25	0. 00& 23. 00L	Fittings and Fasteners	No Damage Pe (If Used)		
Depressi on Stop					No Damage Pe Within 3" Ra	rmitted dius of	
Attachment	104. 55	30. 25	5. 85L	Honeycomb Panel	Attachments		

Table 4-2. Damage Limits Forward Fuselage - Condition I (Cont)

COMPONENT/ NEMBER FS WL BL Flanges, Angles, Caps, Splices, Clips No Damage Permitted			1able 4-2	. Dalliage L	imits forward fuser		(CONT)	
MEMBER FS WL BL Flanges, Angles, Caps. Splices,							MITS	
MEMBER FS WL BL Flanges, Angles, Caps. Splices,	COMPONENT/		LOCATI ON		ELEMENT	CAP/FLANGE	SKI N/WEB	
Passenger Seat Back 114.79- 114.79- 117.70- 122.20 72.00		FS			1	CD' CL' N	WI'N	NOTES/CAUTIONS
Seat Back 114, 79- 31, 42- Caps, Splices, Clips No Damage Permitted		. 0			Flanges Angles			
Bul khead 122, 20 72, 00 Web 1, 10 5	Soat Rack	111 70	21 //			(B IMOL)	(D IVANE)	
117, 90						No Damago Por	omi ++ad	
122 20	Bui knead				CIIPS	NO Dallage Pet	IIII LLEU	
115. 10- 35. 39- 17. 80L Honeycomb Door Assembly					M. I		4 40 5	
117. 70 49. 98			/2.00				1.10 5	
The content of the								
The content of the		117. 70	49. 98	17. 80R				
Sul khead FS130, Upper 130 72.00 Frame Caps 0.30 0.60 10		114. 76-	31. 42-		Honeycomb Panel		1.50 5	
Bul khead FS130, Upper 130 72.00 Frame Caps 0.30 0.60 10 130 72.00 Frame Webs 2.40 5 130 72.00 Frame Webs 2.40 5 Bul khead FS130, Lower 130 51.52 Honeycomb Panel 8.00 5 130 29.70 Honeycomb Panel 3.00 5 Aft Cabin 120.00- 50.04- Inner Skin and Doublers 3.70 5 117. 71- 50.04- 130.00 67.20 25.25L Outer Skin and Doublers 4.30.00 67.20 25.25L Outer Skin and Doublers 8.00 5 117. 71- 50.04- 130.00 67.20 25.25R Door Panel 6.00 5 117. 71- 50.04- 130.00 67.20 25.25R Door Panel 7.20.00 For Skin and Doublers 8.00 5 117. 71- 50.04- 130.00 67.20 25.25R Door Panel 7.20.00 For Skin and Doublers 8.00 5 117. 71- 50.04- 130.00 67.20 25.25R Setween Inner & Outer Skin 1.50 5 117. 71- 50.04- 130.00 67.20 25.25L&R Setween Inner & Outer Skin 1.50 5					Assembly			
FS130, Upper	Bul khead				, , , , , , , , , , , , , , , , , , ,			
130 72.00 Frame Caps 0.30 0.60 10			51 72-		Inboard Outboard			
130 72.00 Frame Webs 2.40 5		120				0 30 0 60 10		
130 72.00 Frame Webs 2.40 5	oppei	130	72.00 51.70		Traile caps	0. 30 0. 60 10	 	
Since Supports S		120			Frama Waha		2 40 E	
Bul khead FS130, Lower 130 29.70- Honeycomb Panel 8. 00 5 130 29.70- Honeycomb Panel 20. 00- 51. 52 Honeycomb Panel 130. 00 5 Honeycomb Panel 3. 00 5		130	72.00				2.40 5	
Bul khead FS130, Lower 130 51.52 Honeycomb Panel 8. 00 5 130 29. 70 Honeycomb Panel 3. 00 5 Aft Cabi n 120. 00- 50. 04- Inner Ski n and Doubl ers 3. 70 5 117. 71- 50. 04- 130. 00 67. 20 25. 25L Outer Ski n and Doubler Shi n a								
FS130, Lower 130 29.70- Honeycomb Panel 8.00 5 130 29.70 Honeycomb Panel 3.00 5 Aft Cabin 120.00- 50.04- Inner Skin and Doublers 3.70 5 117. 71- 50.04- 25.25L Outer Skin and Door Panel 130.00 67.20 25.25R Outer Skin and Door Panel 130.00 67.20 25.25R Outer Skin and Door Panel 6.00 5 117. 71- 50.04- 130.00 72.00 25.25L&R Outer Skin 10.00 5 117. 71- 50.00- 25.25L&R Outer Skin 10.00 5 117. 71- 50.00- 3		130	72.00		Supports, Franges	0.30 0.60 10		
Lower 130 51.52 Honeycomb Panel 8.00 5 130 29.70 Honeycomb Panel 3.00 5 Aft Cabin Enclosure 120.00- 50.04- 130.00 69.00 20.55L&R and Doublers 1nner Skin and Doublers 3.70 5 117.71- 50.04- 130.00 67.20 25.25L 0uter Skin and 130.00 67.20 25.25R Door Panel 0uter Skin and Doublers 6.00 5 117.71- 50.04- 130.00 67.20 25.25R Door Panel Intercoastals Between Inner & Outer Skin 1.50 5 1.50 5 117.71- 50.00- 130.00 72.00 25.25L&R Outer Skin 1.50 5 Angles, Supports, Flanges, 1.50 5								
130 29.70 Honeycomb Panel 3.00 5 Aft Cabin 120.00- 50.04- Inner Skin and Doublers 3.70 5 117.71- 50.04- 130.00 67.20 25.25L Outer Skin 6.00 5 117.71- 50.04- 130.00 67.20 25.25R Door Panel 6.00 5 117.71- 50.04- 17.71-	FS130,		29. 70-					
130 29.70 Honeycomb Panel 3.00 5 Aft Cabin 120.00- 50.04- Inner Skin and Doublers 3.70 5 117.71- 50.04- 130.00 67.20 25.25L Outer Skin 6.00 5 117.71- 50.04- 130.00 67.20 25.25R Door Panel 6.00 5 117.71- 50.04- 17.71-	Lower	130	51. 52		Honeycomb Panel		8.00 5	
130 29.70 Honeycomb Panel 3.00 5 Aft Cabin 120.00- 50.04- Inner Skin 3.70 5 117.71- 50.04- 130.00 67.20 25.25L Outer Skin 6.00 5 117.71- 50.04- 130.00 67.20 25.25R Door Panel 6.00 5 117.71- 50.04- 130.00 67.20 25.25R Door Panel 6.00 5 117.71- 50.00- 11			20. 00-		-			
Aft Cabin 120.00- 50.04- 20.55L&R and Doublers 3.70 5 117.71- 50.04- 130.00 67.20 25.25L Outer Skin 6.00 5 117.71- 50.04- 130.00 67.20 25.25R Door Panel 6.00 5 117.71- 50.00- 17.71- 50.00- 25.25L&R Outer Skin 10.00 5 117.71- 50.00- 25.25L&R Outer Skin 10.00 5 117.71- 50.00- 25.25L&R Outer Skin 10.00 5 Angles, Supports, Flanges, Supports, Flanges,		130			Honeycomb Panel		3.00 5	
Enclosure 130.00 69.00 20.55L&R and Doublers 3.70 5 117.71- 50.04-	Aft Cahin		50 04-		Inner Skin			
117. 71- 50. 04- 130. 00 67. 20 25. 25L Outer Skin 6. 00 5 117. 71- 50. 04- 130. 00 67. 20 25. 25R Door Panel 6. 00 5 Intercoastal s Between Inner & 0 130. 00 72. 00 25. 25L&R Outer Skin 1. 50 5 Angles, Supports, Flanges,				20 55L&R			3 70 5	
130. 00 67. 20 25. 25L Outer Skin 6. 00 5 117. 71- 50. 04- 130. 00 25. 25R Door Panel 6. 00 5 117. 71- 50. 00- 130. 00 25. 25L&R Door Panel 117. 71- 50. 00- 10. 00. 00. 00. 00. 00. 00. 00. 00. 00.	LITCH OSUI C	117 71	50 01-	20.00Lan	22 2002. 0.0		3.700	
117. 71- 50. 04- 25. 25R Door Panel 6. 00 5 117. 71- 50. 00- 17. 71- 50. 00- 25. 25L&R Outer Skin and 17. 71- 50. 04- 25. 25L&R Outer Skin 18. 25. 25L				25 251	Outer Skin		6 00 5	
130. 00 67. 20 25. 25R Door Panel 6. 00 5 117. 71- 50. 00- 25. 25L&R Outer Skin 1. 50 5 Angles, Supports, Flanges,		117 71	50 04	ZJ, ZJL			0.00 3	
The coastal s				2E 2ED			4 00 E	
117. 71- 50. 00- 25. 25L&R Between Inner & 1. 50 5 Angles, Supports, Flanges,		130.00	67.20	25. 25K			0.00 5	
130.00 72.00 25.25L&R Outer Skin 1.50 5 Angles, Supports, Flanges,								
Angles, Supports, 117.71- 50.04- Flanges,								
117. 71- 50. 04- Flanges,		130.00	72.00	25. 25L&R			1.50 5	
117. 71- 50. 04- Flanges,								
		117. 71-	50. 04-					
130.00 72.00 25.25L&R Stilleners 0.50 1.00 0		130.00	72. 00	25. 25L&R	Stiffeners	0.50 1.00 10		

		Table 4-2	. Damage L	imits Forward Fusel		(Cont)	
COMPONENT/ M E M B E		LOCATION W L	BL	ELEMENT	DAMAGE LI CAP/FLANGE CD' CL' N	MLTS SKLN/WEB WL' N	NOTES/CAUTI ONS
Aft Cabin Enclosure Pylon	120. 00- 130. 00		20. 00L	Gun Mount Channel	(D' =NxCL) 1.00 2.00 10	(D'=NxWL)	
Support	98. 80 123. 62	73. 93	7. 52L&R	Forward Support	No Damage Al	Lowed	
Cabin Roof Beam	80. 46- 130. 00	71. 92 67. 92-	6. 25L&R	Aft Support Beam, Left and	No Damage Al		
ROOT Bealli	130.00 101.67& 123.62	71. 96 67. 92- 71. 96	3. 00L&R O	Right Bulkheads Between Beams	No Damage Al No Damage Al	=	
	120. 90	67. 92- 71. 96	3. 00L- 3. 00R	Bul khead Ski n and Doubl er	No Dallage Al	2. 00 5	
	80. 46- 130. 00	67. 92	3. 00L- 3. 00R	Bottom Skin and Access Cover		0. 75 5	
Lower Cabin Shell	73.18- 113.00	20. 00- 25. 25	18.40L&R- Outboard	Radius and Edge of Honeycomb Panel		1.00 5	
	73. 18- 113. 00		18. 40L- 18. 40R	Honeycomb Panel		6. 30 5	No Damage Within 3" Radius of Inserts
	113. 00- 130. 00 96. 44	20. 00- 54. 65 20. 00		Honeycomb Panel Splice	0. 75 1. 50 10	6. 30 5	No Damage Within 3" Radius of Inserts
	36. 00- 130. 00	20. 00- 54. 65		Frames, Angles, Stiffeners	0. 50 1. 00 10		
Upper Cabin Roof Shell	54.48- 82.86			Top Skin		3.00 5	
	82. 86- 125. 00			Honeycomb Panels		3.00 5	
	120. 40- 130. 00		14. 12L&R -Outboard	Honeycomb Panels		2.50 5	
	125. 00- 130. 00		14. 12L- 14. 12R	Titanium Panel		2.50 5	

Table 4-2. Damage Limits Forward Fuselage - Condition I (Cont)

COMPONENT/		LOCATI ON	I BL	ELEMENT	DAMAGE LI CAP/FLANGE CD' CL' N	SKIN/WEB	NOTES /CALITLONS
MEMBER	FS	WL	BL _			WL' N	NOTES/CAUTIONS
Upper Cabin Roof Shell	54. 48- 130. 00			Flanges, Formers, Stiffeners, Supports	(D' =NxCL) 0. 60 1. 20 10	(D =NXWL)	
Landi ng	73. 00&	18. 30&	13. 30L&R	Supports Fitting	0.00 1.20 10		
Gear	130.00	20. 75	& 10. 25L&R	Flanges	Damage Al	lowed On O	ne Flange
	130.00	20. 75	10. 25L&R	Cross Tube Aft Strap	0. 31 0. 62 -		
	73.00	18. 30	13. 30L&R	Cross Tube Forward Strap	0. 10 0. 20 -		
	73.00%	18. 30& 20. 75	13. 30L&R & 10. 25L&R	Back-Up Supports	No Damage Al	Lowed	
	73. 00& 130. 00	18. 30& 20. 75	13. 30L&R & 10. 25L&R	Attachment Fasten- ers and Inserts	Damage Allowed Fastener & Inse Fitting		
Jacking & Tiedown Fittings			_	Fitting	Damage Limited I Tiedown requirem		
Anti - Torque Support	35. 66	21. 00	5. 04L- 3. 04R	Fitting	No Damage Al	I owed	-
Collective Jackshaft Bearing	70.40	20 / 2	1 50		N. D. All		
Support	73. 12	28. 62	1. 50L	Fitting	No Damage Al	Lowed	
Anti - Torque Support							
Fi.tti.ng	7895	23.83	_3.06L	Fi.tti.ng,	No Damage Al	Lowed	

Table 4-3. Damage Limits Aft Fuselage - Condition I

		Tab	1e 4-3. Da	illage Li III ts Ai t Fus			
				EL EMENT		MITS CKLNIAMED	-
COMPONENT/		LOCATION		ELEMENT		SKIN/WEB	NOTEC (CALITI ONC
MEMBER	FS	WL	BL			WL' N	NOTES/CAUTIONS
Upper	130. 00-	72. 00-	14. 12-		(D' =NXCL)	(D' =NXWL)	
Longeron	205.00	72. 93	4. 72L&R	Channel	` No Damage Al	Lowed	
	130.00&						
	167.00			Splice	No Damage Al	Lowed	
				Tail Boom Attach			
	205.00			Fittings	No Damage Al	Lowed	
Center	130, 00-	51. 67-	25. 5-				
Longeron	206. 35	61. 76	2. 79L&R	Angle and Channel	No Damage Al	Lowed	
Longor on	130.00	51. 67		Splice	No Damage Al	Lowed	
	100.00	01107		Tail Boom Attach	J		
	206. 35	61. 76		Fittings	No Damage Al	Lowed	
Lower	130.00-	29. 40-	22. 50-	i i i i i i i i i i i i i i i i i i i	1 1 3 1		
Longeron	192. 84	44. 50	1. 10L&R	Angl e	No Damage Al	Lowed	
Longeron	172.04	77. 00	1. TOLAN	7 (191 C			
	130.00	29. 40		Splice	No Damage Al	Lowed	
	130.00	Lower				I	
Aft	130.00-	Longeron					
Fusel age	206. 35	Upward		Stiffeners	0. 52 1. 04 10		
i user age	200. 33	Lower		3th Felici 3	0.02 1.01 10		
		Longeron					
	130.00-	to Upper					
	206. 35			Skin		3.0 5	
	200. 33	Longeron Lower		JKITI		3.0 3	-
	130.00-						
		Longeron		Doublers		3.0 5	
	206. 35	Upward		noani ei 2		J 0. 0 3	
	120 00	Lower			Same Limits As A	ttachi na	
	130.00-	Longeron		Clinc	Structure	it tacill rig	
T D	206. 35	Upward		Clips	3ti uctui e		
Tail Boom	192.84-	73. 34-		Ckin		8.0 5	
Access Door	205. 76	61. 76	0.001	Skin		0.0 5	
	179. 92 -	70.00	8. 33L-	Club		20 -	
Deck	205. 76	72. 00	8. 33R	Skin		3.0 5	No Domogo Wi +bi is
	167. 00 -		10.18L-	Honeycomb Support		200 -	No Damage Within
<u>Oil Cooler</u>	179. 92	72. 00	10. 18R	Panel	N = 1\ =	200 5	3" of Inserts
	171. 50	72. 00	0	Pan & Drain	No Damage Al	rowed	

Table 4-3. Damage Limits Aft Fuselage - Condition I (Cont)

		Table 4	J. Damage	LI III I S AI I TUSET AY		MITS	· · · · · · · · · · · · · · · · · · ·
OOMBONENT /		LOCATION		EL EMENT			
COMPONENT/		LOCATI ON		ELEMENT	CAP/FLANGE	SKI N/WEB	
MEMBER	FS	WL	BL		CD' CL' N	WL' N	NOTES/CAUTIONS
Anti-					(D' =NxCL)	$(D' = N \times WL)$	
Torque	179. 92-	58. 27-		Support and	,	. ,	
Support	181. 62	73. 37	0. 88R	Fittings	No Damage Al	Lowed	
σαρροί τ	130. 00-	70.07	14. 12L-	Hori zontal	TVO Bamage 71	1 01100	
[[]		71 71		Sti ffeners	1 00 2 00 10		
Engine Pan	167.00	71. 74	14. 12R	3ti i i ellei S	1.00 2.00 10		
	130. 00-		14. 12L-		5		
	167. 00 130. 00-	71. 74	14. 12R	Web & Drain	No Damage Al	Lowed	
	130. 00-		14. 12L		1/3 of Welds	May	
	167. 00	71. 74	14. 12R	Spot Weld Damage	Be Damaged	3	
				Doublers, Splices			
	130. 00-		14. 12L-	Vertical			
		71 71	14. 12L- 14. 12R	Stiffeners	0. 75 1. 50 10		
	167.00	71. 74		3ti i i ellei S	0. 75 1. 50 10		
	130.00-	51. 67-	25. 00L&R-	611.66	4 4 5 0 00 40		
Canted Web	192. 84	59. 98 51. 67-	7. 00L&R	Stiffeners	1. 15 2. 30 10		
	130. 00-	51. 67-	15. 00L&R				
	192. 84 192. 84-	59. 98	7. 00L&R	Web		4. 75 5	
	192. 84-		7. 00L&R				
Shear Web	206. 35 192. 84-	60. 00	4. 00L&R	Stiffeners	0. 15 0. 30 10		
orioar noo	192 84-	00.00	7. 00L&R				
	206. 35	60.00	4. 00L&R	Webs		3.00 5	
El ectri cal	200, 33	00.00	T. OOLAN	WCDS	Damage Allowed t		
	100.00	00 47					
Compartment	130.00-	29. 47-			Insert in Each G	roup	
Floor	167. 00	34. 46		Inserts	of Four		
							No Damage Within
	130.00-	29. 47-					2" of Effective
	167.00	34. 46		Honeycomb		10.00 5	Inserts
	142, 154	2		<i>y</i>			
	167, 179						
Dulkhaada	192			Frame Section	0. 75 1. 50 10		
Bul kheads				Traille Section	0.75 1.50 10		
	142, 154						
	167, 179			Stiffeners, Clips			
	192			Doubl ers .	0.50 1.00 10		
	142, 154						
	167, 17 9						[
	192			Splices	No Damage Al	Lowed	
	172	<u>I</u>		υρι 1 CC3	No ballage Al	i owcu	

Table 4-3. Damage Limits Aft Fuselage - Condition I (Cont)

	_	TUDIC	0	Erim to 711 t Taborag		991112)			
					DAMAGE_LIMITS				
COMPONENT/		LOCATI ON		ELEMENT	CAP/FLANGE	SKI N/WEB			
MEMBER	FS	WL	BL		CD' CL' N	WL' N	NOTES/CAUTIONS		
					(D' = NxCL)	$(D' = N \times WL)$			
Bul khead	205. 74			Frame Section	0. 40 0. 80 10	,			
	205. 74			Angles, Clips	0. 50 1. 00 10				
Engine Mount	1	ı	ı	1					
Mount									
Support	130.00		8. 465L&R	Back-Up Structure	No Damage Al				
	130.00		3. 50L&R	Fitting	No Damage Al	Lowed			
	142. 33	72.00	12. 96L&R	Fitting	No Damage Al	Lowed			

	Ta	able 4-4.	Damage Li mi	its Tail Boom and	Landing Gear - Co	ondition L	
COMPONENT/ MEMBER		LOCATI (ELEMENT	DAMAGE LI CAP/FLANGE CD' CL' N	MITS SKIN/WEB WL' N	NOTES/CAUTI ONS
Tail Boom	BS 31.94- 42.59	VV L	DL	Intercoastals	(D'=NxCL) No Damage	(D'=NxWL) Allowed	
	31. 92			Attachment Fittings	No Damage Al		
	31. 87- 164. 10			Ski n		At Any Circurm- ference 3.0 5	No Damage Allowed BS164.10-182.40
	31. 87, 42. 59, 79. 82,						
	98. 29, 116. 84, 150. 22			Bul kheads	No Damage Al	Lowed	
	174. 10, 182. 40			Bul kheads	0. 85 1. 70 10	Towed	
	174. 10, 182. 40 ⁻			Fin Supports	0. 17 0. 34 10	_	
	174. 10- 182. 40			Gearbox Mounting Plate	No Damage Al	Lowed	

Table 4-4.	Damage	limits	Tail	Room au	nd Landing	Gear -	Condition	I (Cont)
14015 4-4.	Daillage	LIIIIIL	IQII	ואיטטע פו	iu Lanuiny	acai -	Condition	T (COME)

					DAMAG	E LIMITS		
COMPONENT/		LOCATI	ON	ELEMENT	CAP/FLANGE	SKI	N/WEB	
MEMBER	BS	WL	BL		CD' CL'	N WL'	N	NOTES/CAUTIONS
					(D'=NxCL)	(D':	=NxWL)	
	174.10-			Bell Crank				
Tail Boom	182.40			Support	No Damag	e Allowed	d	
	31.87-			Driveshaft				
	182.40			Support & Hangers	No Damag	e Allowed	d	
Stabilizer	84.57			Spar	0.70 1.40	10		
Fin				Honeycomb Panels		2.0	5	

Table 4-5. Damage Limits Forward Fuselage - Condition II

				DAMAGE L1			
COMPONENT/		LOCATION		ELEMENT	CAP/FLANGE	SKIN/WEB	
MEMBER	FS	WL	BL		CD' CL' N	WL' N	NOTES/CAUTIONS
					(D'=NxCL)	(D'=NXWL)	
			ł	Fin to Antenna		1	
Fin	l			Attaching Flanges	1.20 2.40 10		
				Fin to Boom	No Damage Withi	n 3" of	
				Inserts	Inserts		
Tail Skid				Tube Fitting	No Damage Restr	ictions	
Landing Gear				 Skid Tube		2.00 5	
				Fwd and Aft Cross Tubes	No Damage Al	lowed	
Forward	1.00-	20.00-	5.06R-	Caps, Stiffeners,	110 Damago 111	1	
Console	32.75	44.50	3.06L	Doublers	1.10 2.20 5		
00//00/10	1.00-	20.00-	5.06R-				
	32.75	44.50	3.06L	Skins/Webs		4.50 5	
	32.75-	21.00-	5.06R-	Caps, Stiffeners,			
	55.10	32.50	3.06L	Doublers	0.65 1.30 5		
	32.75-	23.39-	5.06R-				
	44.00	32.50	3.06L	Skins/Webs		4.50 5	
	32.75-	21.00-	5.06R-				
	44.00	23.39	3.06L	Skin		1.00 5	
Honeycomb	44.00-	21.00-	5.06R-				
Panel	57.10	32.50	3.06L	Honeycomb Panel		8.00 5	

Table 4-5. Damage Limits Forward Fuselage - Condition II (Cont) AIRFRAME

COMPONENT/		LOCATION		ELEMENT	CAP/FLANGE	SKI N/WEB	
MEMBER	FS	WL	BL		CD' CL' N	WL' N	NOTES/CAUTIONS
Honeycomb Panel	44. 00- 57. 10	21. 00- 32. 50	5. 06R- 3. 06L	Panel Edges	(D' =NxCL) O. 35 O. 70 5	(D' =NXWL)	
Instrument Panel Shroud	21. 25- 37. 56	44. 15- 51. 95	5. 02R- 3. 02L	Brace	1.50 3.00 5		
Front Seat Support	57. 11	21. 00- 30. 41		Honeycomb Bulkhead		1. 05 5	Does Not Include Manufacturer's Holes
Pilot's & Copilot's Seat	57. 11- 74. 54	30. 41	19. 45L- 22. 15R	Honeycomb Panel		8. 50 5	
Center Bulkhead Section	73. 04	30. 29- 54. 89		Web		12.00 5	
	73. 04	21. 00- 30. 29	10. 64- 17. 31L&R	Vertical Stiffeners	2. 20 4. 40 -		
Pilot's & Copilot's Seat	73. 04	30. 29		Aft Attachment Angle	0. 70 1. 40 5		
Collective Jackshaft	73. 04	21. 00- 30. 29		Support Bracket Channel	1.00 2.00 5		
Pedestal Structure	55. 14- 73. 04	20. 00- 30. 17	5. 06R- 3. 06L	Webs		1.10 5	
	55. 14- 73. 04	20. 00- 30. 17	5. 06R- 3. 06L	Caps/Stiffeners	0.85 1.70 5		
Lower Shell	36. 00- 73. 00	20. 00- 25. 25		Honeycomb Panel		4.50 5	
	36. 00- 73. 00	20. 00		Inserts for Cyclic and Pedal Controls	No Damage in One Controls Within of Inserts	3" Radius	
	73. 00	20. 00	12. 16 & 14. 58L&R	Forward Landing Gear Attachments	Two Diagonal Ins Be Damage	erts May	
Center Post	73. 00- 85. 85	20. 00- 72. 00	3. 00L- 3. 00R	Caps	0. 75 1. 50 5		

		Table 4-5.	Damage L	imits Forward Fusel	age - Condition I	l (Cont)	
COMPONENT/		LOCATION		ELEMENT	CAP/FLANGE	SKIN/WEB	NOTEC (CAUTIONS
MEMBER	FS	WL	BL		CD' CL' N	WL' N	NOTES/CAUTIONS
					(D' =NXCL)	(D' = NXWL)	
Center	73. 00-	24. 48-	3. 00L	Side Webs and			
Post	87. 85	72.00	3. 00R	Doubl ers		4.50 5	
	74. 52-	54. 50-	3. 00L				
	81. 30	72. 00 62. 00-	3. 00R	Front Web		2.50 5	
	80.00-	62. 00-	3. 00L-				
	87. 85	72. 00 20. 00-	3. 00R 3. 00L-	Splices	0. 75 1. 50 5		
	73. 00-	20. 00-	3. 00L-				
	87. 85	72. 00	3. 00R	Stiffeners	0. 75 1. 50 5		
							No Damage Within
Passenger	96. 44-	29. 92-	24. 14L-	Honeycomb Seat		40.00.5	3" of Gun Mount
Seat	114. 57	31. 42	24. 14R	Panel		10.00 5	(If Used)
	96. 44-	24. 70-		Honeycomb Side			
	114. 76	29. 92	23. 08L&R	Panel s		2.00 5	
		20. 00-	23. 08L-	Honeycomb Front			
	96. 44	29. 92	23. 08R	Panel		4.5 5	
				Angles, Side,			
	96. 44-	20. 00-	23. 08L-	Front, Top,			
	114. 76	29. 92	23. 08R	Bottom	0.60 1.20 5		
			0.00 &	Fittings and	No Damage Pe	ermitted	
Gun Mounts	103. 76	30. 25	23. 00L	Fasteners	(If Useď)		
Depressi on					No Damage Pe	ermitted	
stop					Wi thin 1-1/2		
Attachment	104. 55	30. 25	5. 85L	Honeycomb Panel	of Attachmen	ts	
Passenger				Fl anges, Angl es,			
Seat Back	114. 79 -	31. 42-		Caps, Splices,	0 50 4 00 5		
Bul khead	122. 20	72.00		Clips	0.50 1.00 5		
	117. 90 -	48. 25-		l		1 40 5	
	122. 20	72. 00		Web		1. 40 5	
			47.00				
	115. 10 -	35. 39-	17. 80L-	Honeycomb Door		/ 00 5	
	117. 70	49. 98	17. 80R	Assembly		6.00 5	
	114. 76 -	31. 42-		Honeycomb Panel			
	117. 70	49. 98		Assembly		2.00 5	

		Table 4-5	. Damage L	imits Forward Fusel	age - Condition I		
COMPONENT/ MEMBER	FS	LOCATION WL	BL	ELEMENT	CAP/FLANGE CD' CL' N	SKIN/WEB WL'N	NOTES/CAUTI ONS
Bul khead					(D' =NxCL)	(D' =NXWL)	
FS130,	120	51. 72-	l	Inboard, Outboard	0 40 1 20 5	ĺ	
Upper	130	72. 00 51. 72-		Frames, Webs	0.60 1.20 5		
	130	72. 00 51. 72-		Frame, Webs		3.00 5	
Dulkhood	130	72. 00		Clips, Splices Supports, Flanges	0.60 1.20 5		
Bul khead, FS130,		29. 70-					
Lower	130	51. 52		Honeycomb Panel		12.00 5	
	130	20. 00- 29. 70		Honeycomb Panel		4.00 5	
Aft Cabin Enclosure	120. 00- 130. 00	50. 04- 69. 00	20. 55L&R	Inner Skin and Doublers		5. 30 5	
	117. 71 <i>-</i> 130. 00	50. 04- 67. 20	25. 25L	Outer Skin		7. 50 5	
	117. 71 -	50. 04-		Outer Skin and			
1	130. 00	67. 20	25. 25R	Door Panel Intercoastals		7. 50 5	
	117. 71- 130. 00	50. 00 72. 00	25. 25L&R	Between Inner & Outer Skin		2.00 5	
			Zo. Zolan	Angles, Support,		2.00	
	117. 71 <i>-</i> 130. 00	50. 04- 72. 00	25. 25L&R	Flanges, Stiffeners	0. 70 1. 40 5		
Aft Cabin Enclosure	120. 00- 130. 00	63. 71	20. 00L	l Gun Mount Channel	1. 50 3. 00 5		
Pylon Support	98. 80	73. 93	7. 52L&R	Forward Support	No Damage Al	Lowed	
	123. 62	71. 92	6. 25L&R	Aft Support	No Damage Al		
Cabi n Roof Beam	80. 46- 130. 00	67. 92- 71. 96	3. 00L&R	Beam, Left and Right	No Damage Al	Lowed	
DCaiii -					No Damage Al	i Owcu	
	101. 67& 123. 62	67. 92- 71. 96	0	Bulkheads Between Beams	No Damage Al	l owed	I

MEMBER FS WL BL CD' CL' N WL' N NOTES/CAUTIONS			Table 4-5	. Damage L	imits Forward Fusel			
Cabin Roof	COMPONENT/		LOCATI ON		ELEMENI	CAP/FLANGE	SKIN/WEB	NOTEO (ONUTLONO
Roof		FS	WL	BL		I -		NOTES/CAUTIONS
Beam						(D' = NXCL)	$(D_{i} = NXM\Gamma)$	
80.46- 130.00 67.92 3.00 Bottom Skin and Access Cover 1.00 5							0 75 5	
Top Skin Beam		71. 96				2. 75 5		
Table Tabl							1 00 5	
Cabin Shel I 73. 18- 20.00- 113. 40 L&R Or Honeycomb Panel 11.50 5 5 73. 18- 113. 00 25. 25 0utboard Panel 1.50 5 No Damage Within 3" Radi us of Inserts 73. 18- 113. 00 20. 00- 130. 00 54. 65 Honeycomb Panel 10. 00 5 Inserts 130. 00 54. 65 Splice 1.50 3. 00 5 Inserts 10. 00 54. 65 Splice 1.50 3. 00 5 Inserts 10per Cabin 54. 48- 125. 00 Splice 1.50 3. 00 5 Inserts 120. 40- 130. 00 Honeycomb Panel 5 4. 50 5 5 125. 00- 130. 00 14. 12L&R- 0utboard 125. 00- 130. 00 Honeycomb Panel 5 3. 00 5 5 125. 00- 130. 00 14. 12L Titanium Panel 14. 12R 3. 00 5 5 130. 00 10. 25L&R Supports 0. 75 1. 50 5 5 Landing Gear 130. 00 20. 75 10. 25L&R Strap 0. 63 1. 26 5 5 130. 00 18. 30 18. 30 13. 30L&R & Support Fitting Forward Strap 0. 63 1. 26 5 5 5 130. 00 18. 30 13. 30L&R & Sack-Up		130.00	67. 92	3. 00R			1.00 5	
Sheli				40 401 00				
Table							1 50 5	
T3. 18-	Shel I	113. 00	25. 25	Outboard	Panel		1.50 5	W
113.00 20.00 18.40R Honeycomb Panel 10.00 5 Inserts No Damage Within 3" Radius of Inserts 130.00 54.65 Honeycomb Panel 10.00 5 Inserts No Damage Within 3" Radius of Inserts 10.00 5 Inserts								No Damage Within
113. 00- 20. 00- 130. 00 54. 65					l		10 00 5	
113. 00- 130. 00 54. 65		113. 00	20. 00	18. 40R	Honeycomb Panel		10.00 5	
130.00 54.65 Honeycomb Panel 10.00 5 Inserts								No Damage Within
96. 44 20. 00 Splice 1. 50 3. 00 5 36. 00- 20. 00- 130. 00 54. 65 Stiffeners 0. 75 1. 50 5 Upper Cabin Roof Shel 82. 86 Top Skin 4. 50 5 82. 86- 125. 00 Honeycomb Panel s 4. 50 5 120. 40- 14. 12L&R- 130. 00 14. 12L- 130. 00 14. 12R Ti tani um Panel 3. 00 5 125. 00- 14. 12L- 130. 00 14. 12R Ti tani um Panel 3. 00 5 54. 48- 130. 00 18. 30& 13. 30L&R & Supports 0. 75 1. 50 5 Landing 73. 00& 18. 30& 13. 30L&R & Support Fitting Gear 130. 00 20. 75 10. 25L&R Flanges Damage Allowed on Two Diagonal Tabs Ti tani um Panel Tabs			20.00-					
Standing Gear Top Standing Standin			54. 65				10.00 5	Inserts
130.00 54.65 Stiffeners 0.75 1.50 5			20. 00			1.50 3.00 5		
Upper Cabin Roof Shell 82.86 Top Skin 4.50 5								
Roof Shell 82.86 Top Skin 4.50 5 82.86- 125.00 14.12L&R- 0utboard Honeycomb Panels 4.50 5 120.40- 130.00 14.12L&R- 0utboard Honeycomb Panels 3.00 5 125.00- 130.00 14.12L- 130.00 14.12R Ti tani um Panel 3.00 5 54.48- 130.00 13.30L&R & Supports 0.75 1.50 5 0.75 1.50 5 Landing Gear 130.00 20.75 10.25L&R Flanges Flanges Di agonal Tabs Cross Tube Aft Strap 0.63 1.26 5 0.63 1.26 5 73.00 18.30 13.30L&R & Back-Up Forward Strap 0.35 0.70 5			54. 65		Stiffeners	0. 75 1. 50 5		
Roof Shell 82.86 Top Skin 4.50 5 82.86- 125.00 Honeycomb Panels 4.50 5 120.40- 130.00 14.12L&R- Outboard Honeycomb Panels 3.00 5 125.00- 130.00 14.12L- 130.00 14.12L- 14.12R Ti tani um Panel 3.00 5 54.48- 130.00 18.30& 13.30L&R & Supports 0.75 1.50 5 Damage Allowed on Two Di agonal Tabs Cross Tube 130.00 20.75 10.25L&R Strap 0.63 1.26 5 0.63 1.26 5 73.00 18.30 13.30L&R & Forward Strap 0.35 0.70 5 0.35 0.70 5	Upper Cabin							
82.86- 125.00	Roof Shell	82. 86			Top Skin		4.50 5	
120. 40 - 130. 00		82. 86-						
130.00		125. 00			Honeycomb Panels		4.50 5	
130.00		120. 40 -						
130.00 14.12R Ti tani um Panel 3.00 5 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130.00 54.48- 130		130.00		Outboard	Honeycomb Panels		3.00 5	
Flanges, Formers, Stiffeners, Supports O. 75 1.50 5 Landing Gear 73.00% 18.30% 13.30L&R & Support Fitting Damage Allowed on Two Diagonal Tabs Cross Tube Aft 130.00 20.75 10.25L&R Strap O. 63 1.26 5 Cross Tube Forward Strap O. 35 0.70 5 73.00% 18.30% 13.30L&R & Back-Up								
Flanges, Formers, Stiffeners, Supports O. 75 1.50 5 Landing Gear 73.00& 18.30& 13.30L&R & Support Fitting 130.00 20.75 10.25L&R Flanges Damage Allowed on Two Diagonal Tabs Cross Tube Aft 130.00 20.75 10.25L&R Strap O. 63 1.26 5 Cross Tube 73.00 18.30 13.30L&R & Forward Strap O. 35 0.70 5		130.00		14. 12R			3.00 5	
54. 48- 130. 00 Stiffeners, Supports 0. 75 1. 50 5 Landing Gear 73. 00& 18. 30& 13. 30L&R & Support Fitting 130. 00 Damage Allowed on Two Diagonal Tabs Cross Tube Aft 130. 00 20. 75 10. 25L&R Strap 0. 63 1. 26 5 Cross Tube 73. 00 18. 30 13. 30L&R Forward Strap 0. 35 0. 70 5 73. 00& 18. 30 13. 30L&R & Back-Up					Flanges, Formers,			
Landing 73.00& 18.30& 13.30L&R & Support Fitting Damage Allowed on Two Diagonal Tabs Cross Tube Aft 130.00 20.75 10.25L&R Strap 0.63 1.26 5 73.00 18.30 13.30L&R Forward Strap 0.35 0.70 5 73.00& 18.30& 13.30L&R & Back-Up		54. 48-			Stiffeners,			
Landing Gear 73.00% 18.30% 13.30L&R & Support Fitting 130.00 Damage Allowed on Two Diagonal Tabs 130.00 20.75 10.25L&R Flanges Diagonal Tabs 130.00 20.75 10.25L&R Strap 0.63 1.26 5 130.00 18.30 13.30L&R Forward Strap 0.35 0.70 5 73.00 18.30 13.30L&R & Back-Up		130.00			Supports	0. 75 1. 50 5		
Gear 130.00 20.75 10.25L&R Flanges Diagonal Tabs 130.00 20.75 10.25L&R Strap 0.63 1.26 5 73.00 18.30 13.30L&R Forward Strap 0.35 0.70 5 73.00& 18.30& 13.30L&R Back-Up	Landi ng		18. 30&	13.30L&R &	Support Fitting		on Two	
Cross Tube Aft 130.00 20.75 10.25L&R Strap 0.63 1.26 5 Cross Tube 73.00 18.30 13.30L&R Forward Strap 0.35 0.70 5 73.00& 18.30& 13.30L&R & Back-Up				10. 25L&R	Flanges			
130.00 20.75 10.25L&R Strap 0.63 1.26 5 Cross Tube 73.00 18.30 13.30L&R Forward Strap 0.35 0.70 5 73.00& 18.30& 13.30L&R & Back-Up					Cross Tube Aft			
73.00 18.30 13.30L&R Forward Strap 0.35 0.70 5 73.00& 18.30& 13.30L&R & Back-Up		130.00	20. 75	10. 25L&R	Strap	0.63 1.26 5		
73.00% 18.30% 13.30L&R & Back-Up					Cross Tube			
73.00% 18.30% 13.30L&R & Back-Up		73, 00	18. 30	13. 30L&R	Forward Strap	0.35 0.70 5		
130.00 20.75 10.25L&R Support No Damage Allowed			18. 30&	13. 30L&R 8				
		130.00	20. 75	10. 25L&R	Support	No Damage Al	Lowed	

TM 55-1520-228-BD AI RFRAME

COMPONENT/		LOCATION		ELEMENT	CAP/FLANGE SKIN/WEB	
MEMBER	FS	WL	BL		CD' CL' N WL' N	NOTES/CAUTIONS
					(D'=NxCL) (D'=NxWL)	
					Damage Allowed on One	
Landing	73.00&	18.30&	13.30L&R &	Attachment Fast-	Fastener and Insert Per	
Gear	130.00	20.75	10.25L&R	eners and Inserts	Fitting	-
Jacking &						
Tiedown					Damage Limited By Jacking	
Fittings				Fitting	and Tiedown Requirements	
Anti-Torque			5.04L-			
Support	35.66	21.00	3.04R	Fitting	No Damage Allowed	
Collective						
Jackshaft						
Bearing		ł				
Support	73.12	28.62	1.50L	Fitting	No Damage Allowed	
Anti-Torque						
Support						
Fittings	78.95	23.83	3.06L	Fitting	No Damage Allowed	

Table 4-6. Damage Limits Aft Fuselage - Condition II

001/001/51/7/	LOCATION		IT / LOCATION ELEMENT				DAMAGE LI	MITS SKIN/WEB	
COMPONENT/		LOCATION		ELEMENT	CAP/FLANGE				
MEMBER	FS	WL	BL	<u></u>	CD' CL' N	WL' N	NOTES/CAUTIONS		
Upper	130.00-	72.00-	14.12-		(D'=NxCL)	(D'=NxWL)			
Longeron	205.00	72.93	4.72L&R	Channel	1.50 3.00 5				
	130.00&								
	167.00			Splice	No Damage Al	lowed			
				Tail Boom Attach					
	205.00			Fittings	No Damage A1	lowed			
Center	130.00-	51.67-	25.50-	Angle and					
Longeron	206.35	61.76	2.79L&R	Channel	0.90 1.80 5				
	130.00	51.67		Splices	No Damage Al	lowed			
				Tail Boom Attach					
	206.35	61.76		Fittings	No Damage Al	lowed			
Lower	130.00-	29.40-	22.50-						
Longeron	192.84	44.50	1.10L&R	Angle	0.85 1.70 5				
	130.00	29.40		Splice	No Damage Al	1 owed			

		Table 4	-6. Damage	Limits Aft Fuselag	e - Condition II	(Cont)	
					DAMAGE LI	MITS]
COMPONENT/		LOCATION		ELEMENT	CAP/FLANGE	SKIN/WEB	
MEMBER	FS	WL	BL		CD' CL' N	WL' N	
					(D'=NxCL)	(D'=NXWL))[
Aft	130.00-	Longeron					
Fuselage	206.25	Upward		Stiffeners	0.75 1.50 5		
		Lower					
		Longeron					
	130.00-	to Upper					
	206.25	• • •		Skin		3.75 5	
		Lower					
	130.00-	Longeron	•				
	206.35			Doublers		3.75 5	
		Lower					
	130.00-	Longeron					
	206.35			Clips	Same Limits	as Attacl	ning Structure
Tail Boom	192.84-						
Access	205.76	61.76		Skin	,	11.0 5	
	179.92-		8.33L-				
Deck	205.76	72.00	8.33R	Skin		3.75 5	
	167.00-		10.18L-	Honeycomb Support			No Damage Within
Oil Cooler	179.92		10.18R	Pane1		3.00 5	2" of Inserts
	171.50	72.00	0	Pan & Drain	No Damage Al	lowed	
Anti-Torque	179.92-	58.27-		Support &			
Support	181.62	73.37	0.88R	Fittings	No Damage Al	lowed	
	130.00-		14.12L	Horizontal			
Engine Pan	167.00	71.74	14.12R	Stiffeners	1.20 2.40 5	<u></u>	
	130.00-		14.12L				
	167.00		14.12R	Web & Drain	No Damage Al		
	130.00-		14.12L-		1/2 of Welds	May	
	167.00		14.12R	Spot Weld Damage	Be Damaged	-	
	130.00-		14.12L-	Doublers, Splices		1	
1	167.00		14.12R	Vertical Stiffener	0.85 1.70 5		
	130.00-		25.00-				
Canted Web		59.98	7.00L&R	Stiffeners	1.50 3.00 5		
	130.00-		25.00-				
i	192.84	59.98	7.00L&R	Web		5.40 5	

Table 4-6. Damage Limits Aft Fuselage - Condition II (Cont)

					DAMAGE LI	MITS	
COMPONENT/		LOCATION	l	ELEMENT	CAP/FLANGE	SKIN/WEB	
MEMBER	FS	WL	BL		CD' CL' N	WL' N	
					(D' =NxCL)	$(D' = N \times WL)$	
	192. 84 -		7. 00-				
Shear Web	206. 35	60. 00	4. 00L&R	Stiffeners	0. 40 0. 80 5		
	192. 84-		7.00-				
	206. 35	60.00	4. 00L&R	Webs		3.60 5	
El ectri cal	100.00	00 47			Damage Limited		
Compartment		29. 47-		1	Inserts in Each	Group	
Floor	167. 00	34. 46		Inserts	of Four	т	No Domosio Within
	100 00	20 47					No Damage Within
	130.00-	29. 47-		Honovoomb		15.0 5	2" of Effective Inserts
	167.00	34. 46		Honeycomb		15.0 5	THSELLS
	142, 154 167, 179						
Bul kheads	192			Frame Section	1. 10 2. 20 5		
Dui Kileaus	142, 154			Traile Section	1. 10 2. 20 3		
	167, 179			Stiffeners,			
	192			Clips, Doublers	0. 70 1. 40 5		
	142, 154			orr per bederere	0170 1110 0	l	
	167, 179						
	192			Splices	No Damage Al	Lowed	
Bul khead	205. 74			Frame Section	1.50 3.00 5		
	205. 74			Angles, Clips	0. 70 1. 40 5		
Engi ne							
Mount							
Support	130.00		8. 465L&R	Back-Up Structure	No Damage Al		
	130. 00		3. 50L&R	Fitting	No Damage Al		
	142. 33	72. 00	12. 96L&R	Fitting	No Damage Al	Lowed	

Table 4-7. Damage Limits Tail Boom and Landing Gear - Condition II

COMPONENT/	LOCATION		ELEMENT	DAMAGE LI CAP/FLANGE			
MEMBER	FS	WL	BL		CD' CL' N	WL′ N	NOTES/CAUTIONS
	31. 92-]	(D' =NxCL)	(D' =NxWL	
Tail Boom	42. 59			Intercoastals	No Damage Al	lowed _	
	04 00			Attachment	No Domogo Al	Lowed	
ļ	31. 92			Fittings	No Damage Al	At Any	
	31. 87- 164. 10 31. 87,			Skin		Circum- ference 6.00 5	No Damage Allowed BS164.10-182.40
	42. 59, 79. 82 98. 29						
	116. 84 150. 22			Bul kheads	1.00 2.00 5	_	
	174. 10- 182. 40			Bul kheads	1. 05 2. 10 5		
	174. 10- 182. 40			Fin Supports	0.50 1.00 5		
	T 174. 10- 182. 40			Gearbox Mounting Plate	No Damage Al	I owed	
	174010- 182. 40 31. 87-			Bell Crank Support	No Damage Al	lowed _	
	182. 40			Driveshaft Sup- port and Hangers	No Damage Al	Lowed	
Stabilizer	84. 57			Spar	1.50 3.00 5		
Fin _				Honeycomb Panels		4.50 5_	
				Fin to Antenna Attaching Flanges	2.60 5.20 5 No Damage Withi	I	
				Γ	No Damage Withi Inserts	n 3" of	
Tail Skid _				<u>Fin to Boom</u> Tube Fitting	No Damage Restr	ictions	
Landi ng Gear				Skid Tube		13. 50 5_	
				Fwd & Aft Cross Tubes		11. 50 5_	

- (5) There are large holes or cracks in an area of the door or hatch exposed to the windstream, and peeling or tearing of the material in flight is probable.
- (6) Fasteners holding major components of the hatch, door, or door jamb together are sheared, pulled-through, or missing at three or more adjoining locations.
- (7) More than 20 percent of the total number of fasteners are similarly damaged.
- k. <u>Evaluation of Damage to Fairings and Cowlings.</u> Classify a damaged fairing or cowling as failed if any of the following conditions exist:
- (1) Damage to the fairing and cowling or its attaching structure prevents it from being adequately secured to the airframe.
- (2) The fairing and cowling shows signs of severe overstress such as crushing, buckling, or misalignment.
- (3) Tracks, rollers, hinges, or latches are damaged in danger of becoming unserviceable in flight.
- (4) Fasteners securing the fairing and cowling are sheared, stripped, pulled-through, or missing at three or more adjoining locations.
- (5) Twenty percent or more of the total number of fasteners are similarly damaged.
- (6) There are large cracks or holes in an area of the fairing and cowling exposed to the windstream, and peeling or tearing of the material in flight is probable.
- 1. <u>Evaluation of Damage to Firewalls.</u> Classify a damaged firewall as failed if any of the following conditions exist:

- (1) The firewall shows sign of severe overstress such as buckling and misalignment.
- (2) Fasteners securing the firewall to the upper deck structure are sheared, stripped, pulled-through, or missing at three or more adjoining locations.
- (3) Twenty percent or more of the total number of fasteners are similarly damaged.
- (4) Damage to the supporting framework causes the firewalls to be loose and subject to collapsing in flight.
- (5) There are large holes or cracks in the firewall that would prevent the firewall from containing a fire.

m. <u>Assessing the Effect of Structural</u> <u>Damage on Other Aircraft Systems</u>.

- (1) The assessment standards provided basically concern the air-worthiness and flight capability of the OH-58 airframe. However, every member of the airframe has a structural and/or functional purpose. Even those members which are unessential to airworthiness may have an important function related to the integrity and performance of other aircraft systems and components. Some of these effects have been considered and are reflected in the assessment standards.
- (2) The assessor is responsible for working with other specialists to determine if damage to airframe structures will overstress, damage, or degrade the performance of other system components. All of the system hardware near the damage should be evaluated for these possible effects. Among the types of conditions to consider are as follows:

- (a) Structural movement which might change the location or alignment of a component. Controls and driveshafts will be particularly critical.
- (b) Structural damage which could affect the security of wire bundles and fluid lines, causing them to vibrate, chafe, and fatigue during flight.
- (c) Damaged structure which might interfere with the free travel or movement of a system component during operation.
- (3) If the assessor determines that structural damage will or might create any of the above conditions,

classify the structure as failed even if the physical damage is within allowable limits.

4-14. BDAR REPAIR PROCEDURE INDEX.

	PARA.
Skin/Stiffener Damage Cap, Skin, Web, Doubler	4-16
Damage	4-17
Cap or Longeron Damage Frame, Bulkhead, Skin and	4-18
Stringer Damage	4-19
Honeycomb Core Floor or	
Panel Damage	4-20
<u>Windshield/Window Damage</u>	4-21
Tail Boom Skin Damage	4-22

Section II. EXPEDIENT STRUCTURAL REPAIRS

4-15. GENERAL.

- a. Many of these expedient repairs will restore the airframe to condition 1. Inspection for damage growth will generally be required after every flight, and damage should be repaired as soon as practical by standard maintenance procedures.
- Multiple Damage. Special attention should be given to structural components which have sustained damage in multiple locations. It is essential that damage to an individual structural item not be considered by itself. Suitable repair will often depend on the condition of the adjacent structure. In some cases, undamaged adjacent structure may satisfactorily take the load of the damaged item. Since time is an overriding consideration on the battlefield, BDAR airframe repairs are usually performed on the outside of the aircraft to save the time required to gain access to If, however, access to the the interior. interior damaged structure is already available, inside BDAR repairs may be made.
- c. Fasteners. BDAR can be carried out using any form of fastening device, which is available at the time (e.g., nuts, bolts, rivets, etc.), as long as strength requirements are met. Use accepted practices regarding fastener edge distance and spacing. The fasteners used in a single repair should be of the same type.
- Metal Selection. All repair patches should be manufactured from material of the same or similar specification as the damaged area but at least one gauge or 10 percent thicker. When required repair materials are unavailable, substitutions can often be made to produce a desired strength. Table 4-8 cross lists various types of metal and instructions on how to substitute one type of metal for another. Alternate repair materials can be obtained from scrapped aircraft. also permissible to fabricate from thinner gauge material and use multiple thi ckness.

		2024			7075 4130 1025 T6 8630 Steel		30	Titanium				Stainless Steel				
MATERIAL TO BE REPLACED	ULTIMATE TENSILE STRENGTH PSI	T3&4 Clad	T4 Extruded	T6 Bare	Steel	Clad	Extruded	90 KSI	125 KSI	99%	8 Mn	6AL -4\	6Al- 6V- 2Sn	1/4 301	1/2	321 347
6061-T6 Extruded	38,000	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.^
AZ31A-H Magnesium	39,000	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
6061-T6 Clad	42,000	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2024-T4 Extruded	57,000	1.0	1.0	1.0	1.04	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2024-T4 Clad	58,000	1.0	1.02	1.0	1.05	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2024-T3 Clad	60,000	1.04	1.05	1.0	1.09	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2024-T6 Bare	62,000	1.07	1.09	1.0	1.13	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2024-T81 Clad	- 64,000	1.1	1.12	1.03	1.16	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2024-T88 Clad	70,000	1.21	1.23	1.13	1.25	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7075-T6 Clad	72,000	1.24	1.27	1.16	1.31	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7075-T6 Bare	78,000	1.35	1.37	1.26	1.42	1.09	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7075-T6 Extruded	78,000	1.35	1.37	1.26	1.42	1.09	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7178-T6 Bare	84,000	1.45	1.48	1.36	1.53	1.17	1.08	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
7178-T6 Extruded	84,000	1.45	1.48	1.36	1.53	1.17	1.08	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Titanium 99Z	80,000	1.38	1.40	1.29	1.45	1.11	1.02	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Type 321 & 347 CRES	100,000	1.72	1.75	1.61	1.82	1.38	1.28	1.11	1.0	1.25	1.0	1.0	1.0	1.0	1.0	1.0
<u>Titanium-8Mn</u>	120,000	2.06	2.1	1.93	2.18	1.66	1.53	1.33	1.0	1.50	1.0	1.0	1.0	1.0	1.0	1.20
Type 301 Stainless	125,000	2.15	2.19	2.09	2.27	1.73	1.60	1.38	1.0	1.56	1.04	1.0	1.0	1.0	1.0	1.25
Titanium 6AL-4V	134,000	2.31	2.35	2.16	2.43	1.86	1.71	I.48	1.07	1.67	1.12	1.0	1.0	1.07	1.0	1.34
<u>Titanium 4Al-4Mn</u>	140,000	2.41	2.45	2.25	2.55	1.94	1.79	1.55	1.12	1.75	1.16	1.04	1.00	1.12	1.0	1.40
Type 301 Stainless	150,000	2.58	2.63	2.42	2.73	2.08	1.92	1.66	1.20	1.88	1.25	1.11	1.0	1.2		1.50
Titanium 6Al-6V-2Sn	155,000	2.67	2.71	2.5	2.81	2.15	1.98	1.72	1.24	1.93	1.29	1.15	1.0	1.24	1.03	

A. LOCATE THE MATERIAL TO BE REPLACED ON THE LINE IN THE LEFT HAND COLUMN.

B. LOCATE THE SUBSTITUTE MATERIAL IN THE VERTICAL COLUMNS.

C. TO OBTAIN THE MINIMUM THICKNESS OF THE SUBSTITUTE MATERIAL, MULTIPLY THE THICKNESS OF THE MATERIAL TO BE REPLACED BY THE FACTOR SHOWN AT THE INTERSECTION OF THE LINE AND COLUMN FOUND IN STEP A & B. SUBSTITUTE STANDARD GAGE EQUAL TO THIS THICKNESS OR NEAREST STANDARD GAGE.

NOTE

- . Steel and aluminum are incompatible materials and normally require special precautions. However, for BDAR, this is an acceptable usage.
- . Refinements to patch repairs, such as countersunk fasteners, chamfered edges, anti-corrosive treatment, and radius corners of the patches are unnecessary.
- e. External patch repairs generally will meet strength criteria for effec-Sometimes these repairs must tive BDAR. take into consideration the clearance of moving parts (e.g., control surfaces, doors, etc). In low stress areas, patches may only be necessary to provide aerodynamic shape to prevent ram air effect or to keep water out. these areas can be covered with thin gauge metal or Army green tape. In some areas, negligible damage can be ignored. Use environmental protection for external repairs if possible. Where an access hole is large or can be made larger for internal repair, an internal or external repair may be used. External repairs should be aligned within 15° either side of the direction of air flow.
- f. General Repair Requirements. Restore structural continuity by restoring original structure or by bridging the damage. Original strength should be restored if possible. Weight and appearance are unimportant in battle damage repair. Structural stiffness should be sufficient to assure loads are properly distributed and to avoid serious vibrations. Use shims to avoid Avoid hand formed and fitted i oggles. Where a stringer/stiffener is light (1-1/2 X 1-1/2 X 0.060 inches or less) and the stringers on either side of the damage or fracture are sound, apply a skin patch 2 gauges thicker over the damaged area.

g. Special Repair Techniques. One method to create a complex curve in a normally straight angle or T - Profile member is to place appropriate cuts and stop drill holes to allow bends, as given in Figure 4-16. This field expedient procedure will allow former repair from stray stock.

4-16. SKIN-STIFFENER DAMAGE.

GENERAL INFORMATION: These repairs are applicable to any skin-stiffener/stringer structure such as the fuselage, fairings, and many secondary structures other than sandwich construction.

OPTION 1: Patch Plate and Substitute Stiffener/Stringer.

LIMITATIONS: None - Condition 1. Inspect after every flight for damage growth.

PERSONNEL/TIME REQUIRED:

- 2 Soldiers
- 2 Hours

MATERIALS/TOOLS REQUIRED:

- Substitute Stiffener or Stringer
- Section
- Skin Patch
- Cherry Rivets (item 37, Appx C)

PROCEDURAL STEPS:

- 1. Remove sections of the aircraft skin and stiffener/stringer containing the damage. Smooth and round the cutout. Cleanup ends of the stiffener/stringer. Stop drill any remaining cracks, Figure 4-17.
- 2. Cut and fit a skin patch one gauge thicker allowing overlap for at least two rows of rivets, Figure 4-18.

4-51

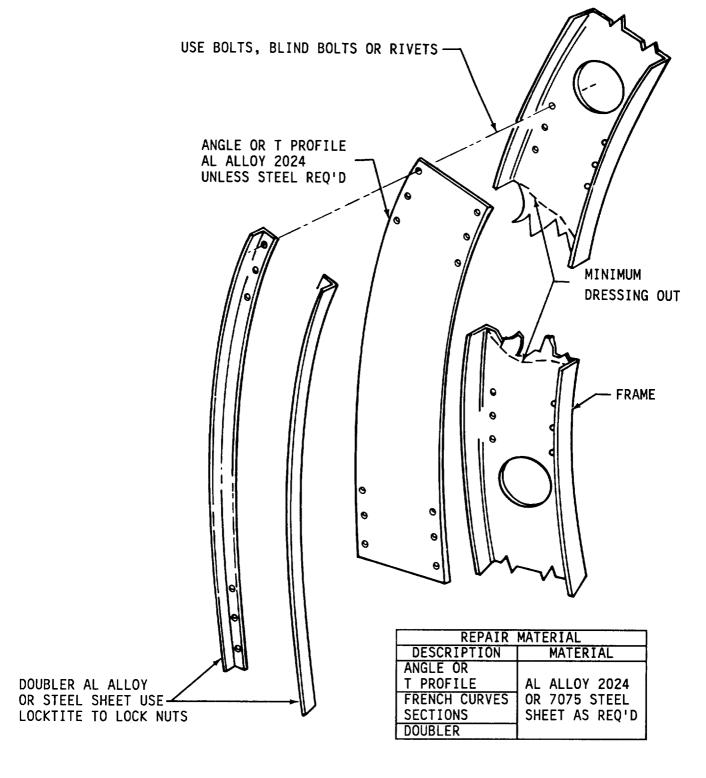


Figure 4-16. Typical Former Repair (Sheet 1 of 2)

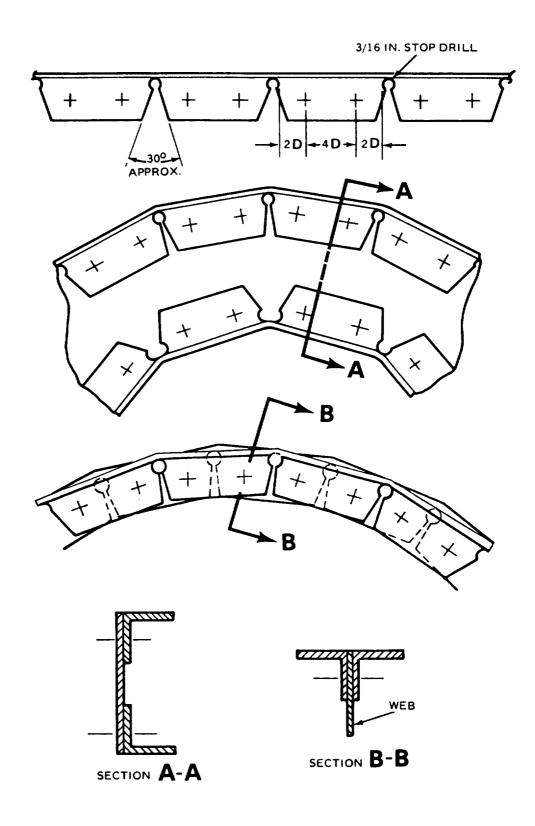


Figure 4-16. Typical Former Repair (Sheet 2 of 2)

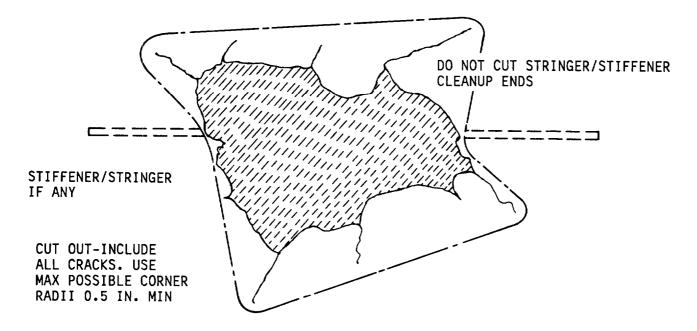


Figure 4-17. Cutout In Damaged Skin

- 3. Cut a piece of substitute stringer or stiffener to extend a minimum of six fasteners beyond the damage on each end. Use an angle, channel, or z-angle extrusion, if available, with a cross section and strength equal to or larger than the existing stiffener/stringer. Sometimes a single substitute stringer or stiffener can be extended to provide support for several damages. This is better than individual repairs, as it will stiffen the airframe.
- 4. Remove rivets in the existing stiffener/stringer and back drill rivet holes in the substitute stiffener/stringer to match existing holes. Attempt to interpitch new fasteners within the existing rivet pattern if the area is inaccessible for back-drilling.
- 5. Rivet the substitute stiffener/ stringer in place, Figure 4-18, using the same size or larger rivets as those removed.
- 6. Rivet patch plate over hole using same size as existing rivets.

NOTE

Stiffener can be placed on outside; however, this configuration is nonpreferred.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Tape Repair.

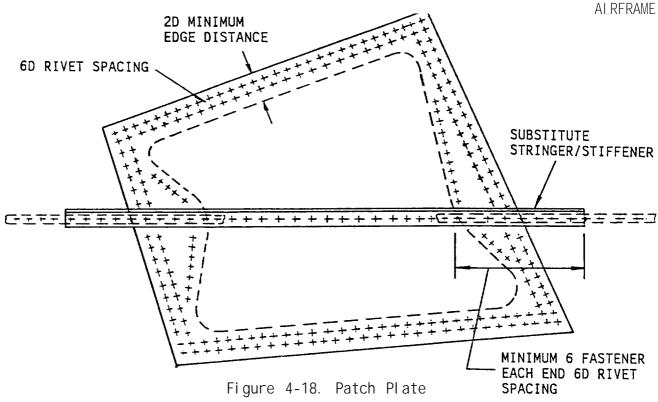
LIMITATIONS: Repair may only be used on secondary structure to keep moisture out. No damage to stiffener/stringer allowed.

PERSONNEL/TIME REQUIRED:

- 1 Sol di er
- 30 Minutes

MATERI ALS/TOOLS REQUIRED:

• Army Green Tape (item 50, Appx C) or Aluminum Tape



PROCEDURAL STEPS:

- 1. Smooth off ragged edges on damaged skin.
- 2. Tape over hole. Use several layers as necessary, and overlap onto skin well beyond damaged area.
- 3. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.
- 4-17. CAP, SKIN, WEB, DOUBLER DAMAGE.

GENERAL INFORMATION: Much of the fuselage construction is relatively light built-up structure. Small damage will likely exceed the allowable limits and will require repair. A patch plate can often be used to repair the damage.

LIMITATIONS: None - Condition 1. Inspect after every flight for damage growth.

PERSONNEL/TIME REQUIRED:

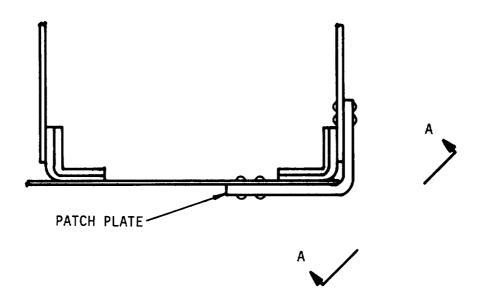
- 2 Sol di ers
- 2 Hours

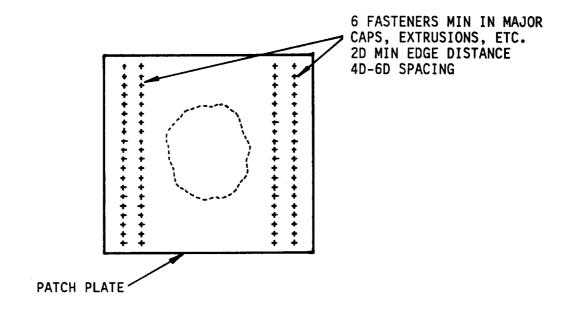
MATERIALS/TOOLS REQUIRED:

- Patch Plate
- Cherry Rivets (item 38, Appx C)

PROCEDURAL STEPS:

- 1. Remove sections of the aircraft containing the damage. Smooth and round the cutouts. Stop-drill any remaining cracks, Figure 4-19.
- 2. Cut and fit a patch plate one gauge thicker and of the same material as the damaged structure. The plate thickness should be based on the thickest part of the damaged area. The patch plate should be large enough to allow installation of the required fasteners on all sides. Cut and fit shims to fill gaps.





SECTION A-A

Figure 4-19. Typical Patch Plate Repair

- 3. Install a minimum of six rivets in each row on each damaged end of major structure such as caps, extrusions, etc. Remove existing rivets and back drill holes in the patch plate if the area is accessible. If back drilling is not practical, it may be possible to interpitch new rivets between existing rivets. Use same size rivets or oversize rivets if necessary.
- 4. Install two rows of rivets around patch plate in webs and skins using same size as adjacent rivets in webs and skin.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

4-18. CAP OR LONGERON DAMAGE.

GENERAL INFORMATION: Nondeferrable cap or longeron damage may be substantial, combined with skin damage. It will generally be necessary to repair the cap or longeron first and then the skin. It may not be necessary to repair the skin for structural reasons, but generally skin repair is recommended to make a watertight repair.

LIMITATIONS: None - Condition 1. Inspect after every flight for damage growth.

PERSONNEL/TIME REQUIRED:

- 2 Soldiers
- 2 Hours

MATERIALS/TOOLS REQUIRED:

- Longeron or Cap Sections used in outside repairs should be angular or channel shaped. The strength of the new cap or longeron should be at least that of the damaged cap or longeron. Refer to Table 4-8 for substitute materials to use on repair if a longeron or cap section is not available.
- Skin Patch
- Blind Rivets (item 41, Appx C)

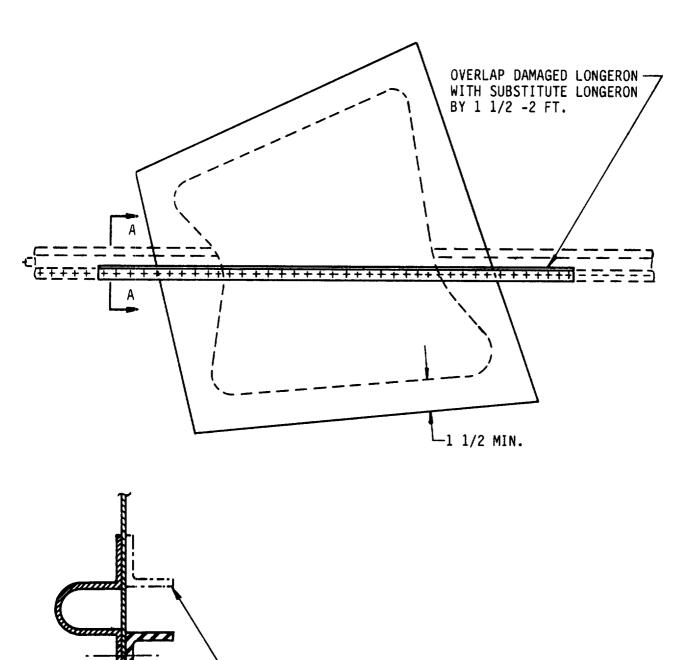
PROCEDURAL STEPS:

- 1. Remove sections of the aircraft skin containing the damage. Do not cut cap or longeron, but cut off ragged ends, Figure 4-20.
- 2. Make a patch plate. Plate should be as strong or stronger than original skin. Overlap the hole for at least 2 rows of rivets.
- 3. Cut a piece of substitute cap or longeron to extend at least six fasteners on all rows fore and aft of damaged section. Sometimes a single substitute cap or longeron can be extended to provide support for several damages. This is better than individual repairs, as it will stiffen the airframe.
- 4. In the areas where the substitute cap or longeron will overlap on the damaged cap or longeron sections, remove rivets which attach the damaged cap or longeron to skin. Back drill rivet holes on the substitute cap or longeron to match existing holes on the damage cap or longeron.
- 5. Rivet the substitute cap or longeron in place using the same size or larger rivets as those removed in step 4.
- 6. Rivet patch plate over hole using blind rivets. Use same size rivets as existing rivets.

NOTE

Stiffener can be placed on outside; however, this configuration is nonpreferred.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.



SECTION A-A

Figure 4-20. Expedient Cap/Longeron Repair

ADD SECOND ANGLE
IF BOTH WERE DAMAGED

4-19. FRAME, BULKHEAD, SKIN, AND STRINGER DAMAGE.

GENERAL INFORMATION: A damaged flange on a bulkhead or frame could be repaired from the outside in the same way as is a cap or longeron. However, it is not desirable to have a section on the outside of the aircraft sticking out normal to the airstream. Frame flanges are therefore repaired by applying a strap over the damage. If the damage to a highly loaded bulkhead is severe, then treat it like a cap and let the section stick out in the airstream.

OPTION 1: Patch Plate Repair for Small Damage.

LIMITATIONS: None - Condition 1. Inspect after every flight.

PERSONNEL/TIME REQUIRED:

- 2 Soldiers
- 2 Hours

MATERIALS/TOOLS REQUIRED:

- Repair Strap
- Cherry Rivets (item 41, Appx C)
- Tape or Skin Patch

PROCEDURAL STEPS:

- 1. Stop drill all cracks, Figure 4-21.
- 2. Cover the damage with tape. Be sure to cover the ends of all cracks.
- 3. Fabricate a repair strap using thick sheet metal. The sheet metal should be 2 X thickness of the original flange material, skin, and stringer. The strap should be wide enough to cover damaged area and to allow at least two rows of rivets on the skin, and a minimum of six rivets in the undamage portion of damaged stringers. The strap should be long enough to overlap both ends of the damaged bulkhead or frame flange by six rivets on each end. In the areas where

the repair strap will overlap on the damaged bulkhead flange and stringer, remove rivets and back drill if the area is accessible. If back drilling is not feasible, interpitch new rivets between existing rivets.

- 4. Rivet the repair strap to the bulkhead or frame flange and stringer using the same size or larger rivets. Rivet the strap to the skin using two rows of rivets around the perimeter using the same size rivets as in adjacent skin-flange structure.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Combination Repair for Major Frame or Bulkhead Damage.

LIMITATIONS: None – Condition 1. Inspect after every flight.

PERSONNEL/TIME REQUIRED:

- 2 Soldiers
- 3 Hours

MATERIALS/TOOLS REQUIRED:

- Filler Patch
- Repair Doubler
- Skin Patch
- Cherry Rivets (item 41, Appx C)

PROCEDURAL STEPS:

- 1. Remove sections of the skin and frame or bulkhead containing the damage. Smooth and round the cutouts, Figure 4-22.
- 2. Cut and fit repair doubler for frame or bulkhead. Cut skin patch allowing overlap for at least two rows of rivets. Repair patch and doubler should be the same material and one gauge thicker than original material.

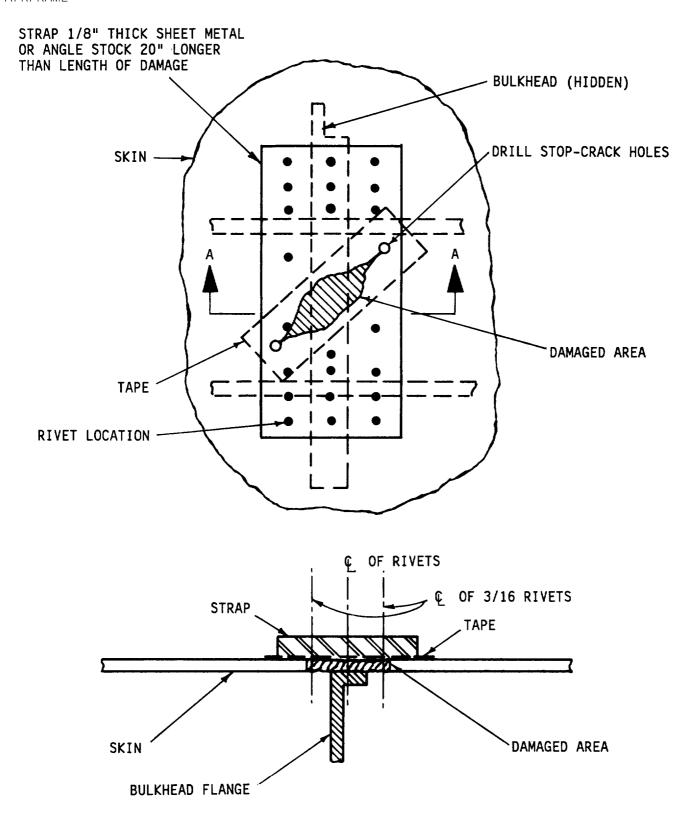
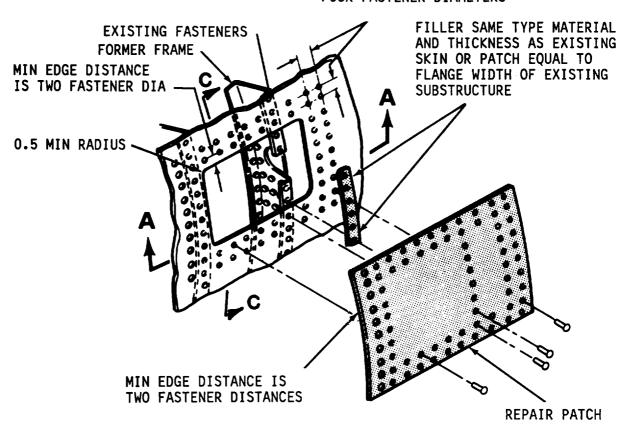


Figure 4-21. Repair of Damaged Bulkhead Flange

FASTENER SPACING IS FOUR FASTENER DIAMETERS



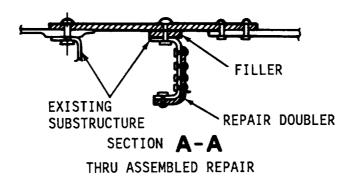
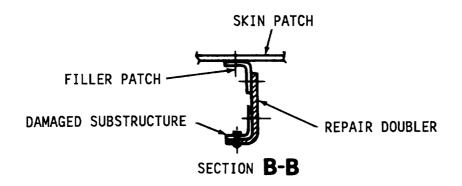


Figure 4-22. Typical Combination Repair (Sheet 1 of 2)



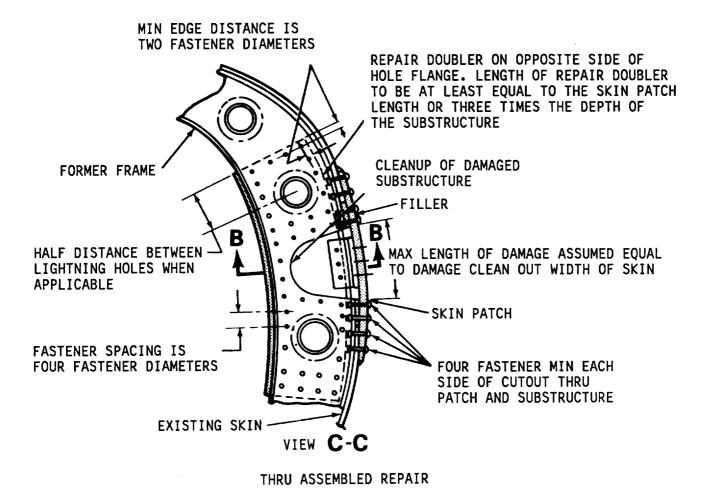


Figure 4-22. Typical Combination Repair (Sheet 2 of 2)

- 3. Remove existing rivets where the repair parts will overlap existing rivets If the area is accessible for back-drilling holes. If not, install rivets between existing rivets if space permits.
- 4. Rivet the repair parts in place using original diameter rivets or larger if necessary.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.
- 4-20. HONEYCOMB CORE FLOOR OR PANEL DAMAGE.

GENERAL INFORMATION:

- a. Part of the bottom shell, top deck, shelves, interior panels, and the fin panels are honeycomb core structures.
- b. Various repair options are given for a range of damage size.

OPTION 1: Small Damage to One Skin and Core or Both Skins and Core - Less Than 2 Inches Maximum Diameter.

LIMITATIONS: Procedure is designed only to keep moisture out. No additional strength has been added.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 15 Minutes

MATERI ALS/TOOLS REQUIRED:

. Army Green Tape (item 47, Appx C) or Aluminized Tape

PROCEDURAL STEPS:

- 1. Remove ragged edges, Figure 4-23.
- 2. Apply tape over repair to keep out moisture.

3. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: 2 to 8 Inch Damage, One Skin and Core.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- •90 Minutes

MATERIALS/TOOLS REQUIRED:

- Metal Set or Equivalent Filler Compound (item 2, Appx C)
- Patch Plate
- •Cherry Rivets (item 38, Appx C)
 . Solvent Cleaner; Naptha (item 5, Appx C) or Equivalent

PROCEDURAL STEPS:

- 1. Remove damaged skin and core, Figure 4-24. Clean surface 6 inches around holes with cleaner. The maximum damaged area that may be cut out is 8 inches.
- 2. Make a patch plate as shown in Figure 4-25. Make plate 2 inches larger than cutout. Lay out and drill rivet pattern.
- 3. Completely fill void with metal set fill compound. Add slight excess to allow for shrinkage.
- 4. Apply metal set to area between the patch plate and panel. Assemble to panel with 1/8 blind rivets.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 3: Damage to Both Skins and Core, 2-8 Inch, Only One Side of Panel is Accessible.

LIMITATIONS: None.

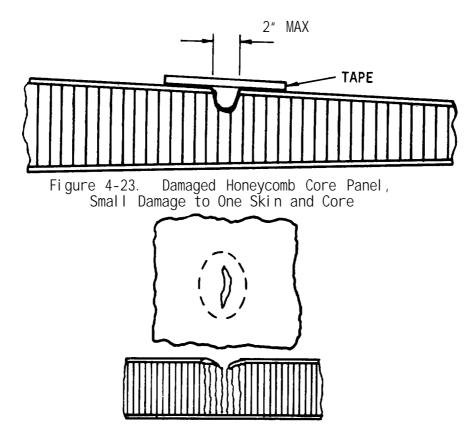


Figure 4-24. Damaged Honeycomb Core Panel, 2-8 Inch Damage - One Skin and Core

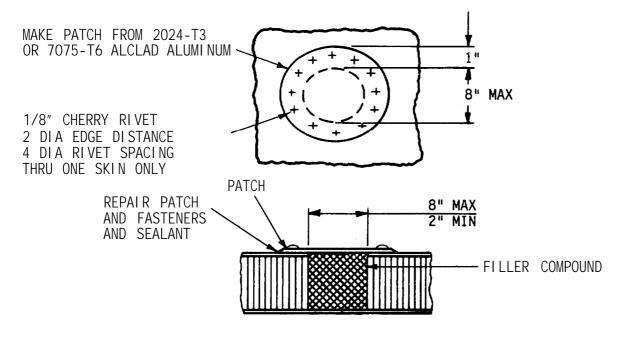


Figure 4-25. Repaired Honeycomb Core Panel, 2-8 Inch Damage - One Skin and Core

PERSONNEL/TIME REQUIRED:

- •1 Soldier
- . 2 Hours

MATERIALS/TOOLS REQUIRED:

. Drill with No. 30 Bit

- Router
- Metal Set (item 2, Appx C) or Equivalent Filler Compound
- •2 Patch Plates
- . Cherry Rivets (item 38, Appx C)
- •Ri vet Gun
- •Solvent (item 47, Appx C)

PROCEDURAL STEPS:

- 1. Remove damaged skin and core using a router to route all damage on outer and inner skins. Enlarge the hole on the outer skin and honeycomb so that a 1 Inch rim surface of the inner skin is exposed, as shown in Figure 4-26.
- 2. Make two patch plates. One patch plate is for inner skin; the other for the outer skin, Figure 4-27.
- 3. Apply sealant to exposed surface of inner skin. Assemble patch plate to the inner skin with cherry rivets.
- 4* Completely fill void with metal set fill compound. Add slight excess to allow for shrinkage.
- 5. Let harden. Sand smooth. Apply seal ant to the area between the outer patch and skin. Assemble patch to outer skin with 1/8 cherry rivets.
- 6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 4: Damage Over 8 Inches to Both Skins and Core.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:

- •1 Soldier
- •2 Hours

MATERIALS/TOOLS REQUIRED:

- . 2 Patch Plates
- •Cherry Rivets

PROCEDURAL STEPS:

- 1. Remove damaged skin and core, Figure 4-28. Clean top and bottom skins 6 inches around holes with cleaner. The maximum damaged area that may be cut out is 12 inches.
- 2. Make two patch plates, 0.04 inch or thicker, as shown in Figure 4-28. (If damage is in an area where installing an interior patch is not possible or where sharp edges from rivets on an interior patch might cause damage, a single exterior patch plate, 0.05 inch thick, may be used.) Make plates 2 inches larger than the cutout. Lay out and drill a rivet pattern, two rows, as shown.
- 3. Assemble with 2 rows of cherry rivets.
- 4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 5: Secondary Structure Repair.

LIMITATIONS: This option is recommended for secondary structural areas, which have a honeycomb core between the walls, where repair is required for aerodynamic reasons or to keep water out of aircraft.

PERSONNEL/TIME REQUIRED:

- •1 Soldier
- . 1 Hour

MATERIAL/TOOLS REQUIRED:

- •Patch Plate, 0.020 Inch (Minimum) Aluminum or Steel
- •Cherry Rivets (item 38, Appx C)
- •Sealant (item 5, Appx C)
- . Rivet Gun
- •Solvent (item 7, Appx C)
- . Drill and Bit

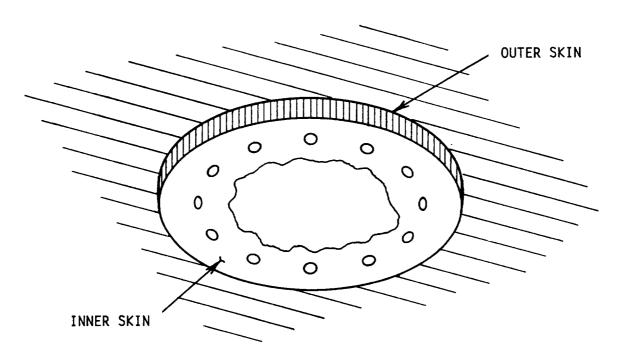


Figure 4-26. Damage Repair, Accessible One Side Only

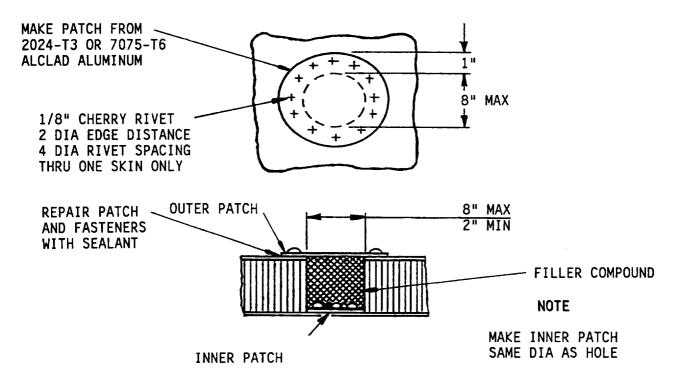
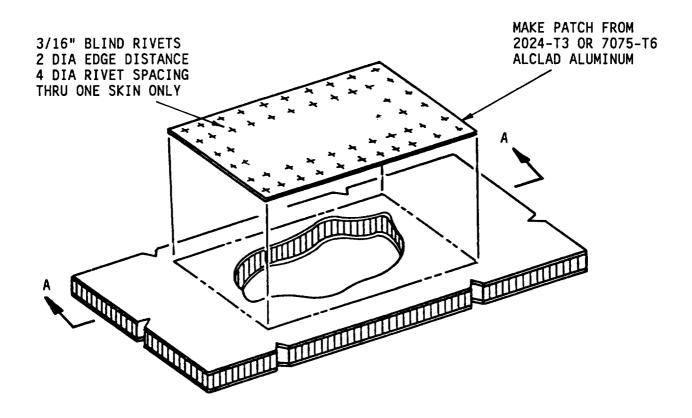


Figure 4-27. Patch Plates, One Side Accessible Repair



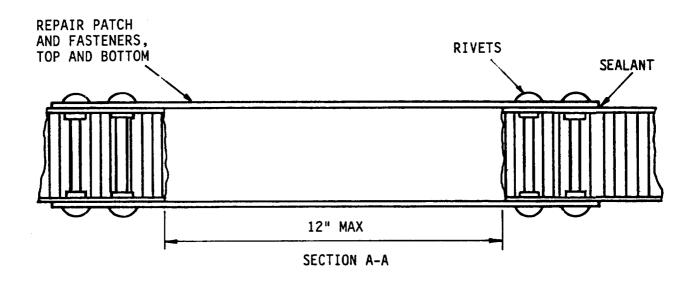


Figure 4-28. Repair of Honeycomb Core Panel, Damage Over 8 Inches - Both Skins and Core

PROCEDURAL STEPS:

- 1. Remove protruding sections of damaged skins and core. Clean area with solvent.
- 2. Cut patch plate to fit over hole, allowing 1 inch overlap on all sides.
- 3. Lay out and drill rivet pattern on overlapping area.
- 4. Apply seal ant to underside of patch plate on overlapping area.
- 5. Assemble patch plate to panel with rivets.
- 6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.
- 4-21. WINDOW SHIELD/WINDOW DAMAGE.

GENERAL INFORMATION: In general, repairs to transparencies are at best make-shift and usually result in serious impairment of clear vision characteristics. Damaged sections should be replaced as soon as possible.

LIMITATIONS: Restricted vision. Inspect after every flight for damage growth.

PERSONNEL/TIME REQUIRED:

- •1 Sol di er
- •1 Hour

MATERI ALS/TOOLS REQUIRED:

- . Safety Wire (item 25, Appx C)
- •Sealant (item 4, Appx C)
- . Tape (item 50, Appx C)

PROCEDURAL STEPS:

1. Stop drill a hole at the end of each crack, Figure 4-29. If tolerable, cut out a hole to include the ends of all cracks. This will restrict vision further. Smooth ragged edges.

- 2. Drill small holes 1/2 to 3/4 inch spacing, 3/8 inch edge distance along both sides of any crack and along the sides of the hole.
- 3. Lace safety-wire with needle nose pliers through holes and across cracks and over hole, forming a web with 1/2 to 3/4 inch spacing between wires. Pull wires tight.
- 4. Brush epoxy sealant over safety wire and crack to make a water tight seal.

NOTE

Holes too large to be closed with safety-wire and epoxy may be sealed temporarily with Army green tape.

5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

4-22. TALL BOOM SKIN DAMAGE.

GENERAL INFORMATION: The tail boom is a basic monocoque structure with no longitudinal skin stiffeners or longerons. The tail boom is unserviceable if damage is extensive enough to cause misalignment. Damage which does not exceed 10 percent of tail boom circumference in height and 30 percent of tail boom circumference in length may be repaired by patching. (Circumference to remeasured at aft end of damage.) A maximum of TWO damaged areas per stress section of the tail boom is permitted. Example, a line drawn around the circumference of the tail boom must not touch more than TWO damaged areas. Damaged areas must be a minimum of 8 inches apart. Total damage to tail boom is not to exceed 5 percent of the tail boom area (approx. 160 square inches).

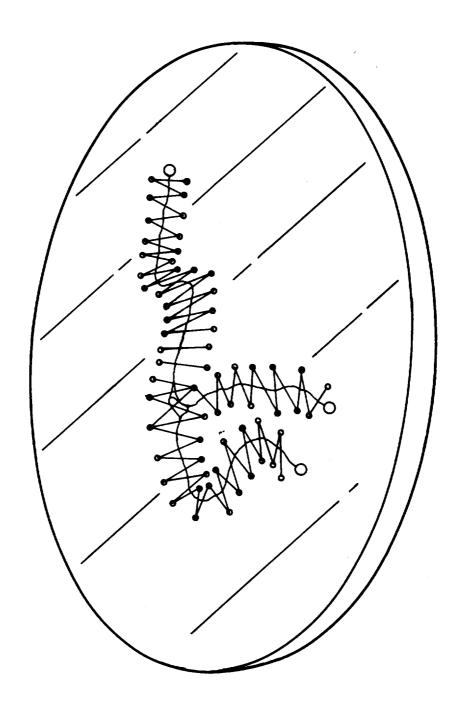


Figure 4-29. Fracture Lacing With Safety Wire

TM 55-1520-228-BD AI RFRAME

LIMITATIONS: None - Condition 1. Inspect after every flight for damage growth.

PERSONNEL/TIME REQUIRED:

- •1 Soldier
- . 2 Hours

MATERIALS/TOOLS REQUIRED:

- •Skin Patch
- •Cherry Rivets (item 37, Appx C)
- •EA93NA Adhesive (item 6, Appx C)

PROCEDURAL STEPS:

1. Remove sections of the tail boom skin containing the damage. Stop drill remaining cracks. Clean up damaged skin using a minimum 0.125 inch radius.

- 2. Prepare a patch of 2024-T3 aluminum 0.050 thick and shape to contour of tail boom. The patch must extend a minimum of 3 inches forward and aft, and 1 inch above and below the damaged area, Figure 4-30.
- 3. Sand surfaces lightly to remove all surface finish. Clean areas with cleaner. Bond patch to surface with EA934NA adhesive.
- 4. Install a minimum of three rows of rivets running circumferentially on each end and a minimum of one row of rivets top and bottom running longitudinally in the patch. Rivet size to be the same as skin lap joints, Figure 4-30.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

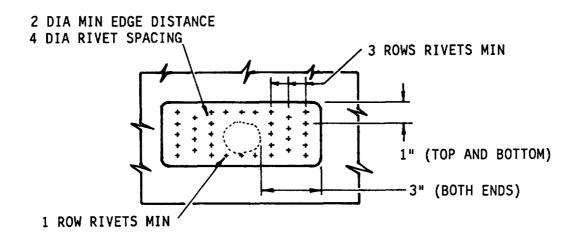


Figure 4-30. Tail Boom Skin Damage

ALIGHTING GEAR

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

- 5-1. SCOPE. This chapter contains information for deferring repair and expedient field fixes of battle damaged alighting gear assembly. The repairs or field fixes can only be applied to the skid tubes.
- 5-2. DESCRIPTION. The alighting gear assembly, Figure 5-1, consists of two tubes (1) and two arched crosstubes (2) and (3) fastened together with skid saddles (4), and attaching hardware. The assembly is attached to the lower structure with support assemblies (5 and 6) at four points.

Replaceable steel skid shoes (7) are attached to the bottom of the skid tubes to prevent damage from contact with the ground.

- 5-3. ASSESSMENT PROCEDURES. Refer to Table 5-1.
- 5-4. REPAIR PROCEDURE INDEX.

		PARA.
Landings, Damage		

Section II. SKID TUBE

5-5 • GENERAL INFORMATION.

a. In battle conditions, part of the skid tube may sustain various amounts of damage which may be deferred.

NOTE

The conditions in this paragraph apply only to damage to the skid tube (1, Figure 5-1).

- b. Deferrable skid tube damage:
- (1) Damage to Sections A and E, Figure 5-2, may include up to complete rupture.
- (2) Damage to the junction of the crosstubes and skid tube, Sections B and D, Figure 5-2, may include up to one-half of the cross section of the skid tube as long as alighting gear is not too badly deformed.

- (3) Damage to Section C, Figure 5-2, may be deferred unless skid tube is so deformed that alighting gear is not functional.
- 5-6. HARD LANDINGS, SUDDEN STOPS.

GENERAL INFORMATION.

- a. Any hard landings which permanently deform the crosstubes, so that the spread of the skid tubes is in excess of 74 inches, may cause damage to the structure, transmission, or rotor.
- b. Binding or unusual noises In the transmission may require replacement of rotor and the transmission. This is not BDAR.

NOTE

Aircraft grounded until assessed flight worthy.

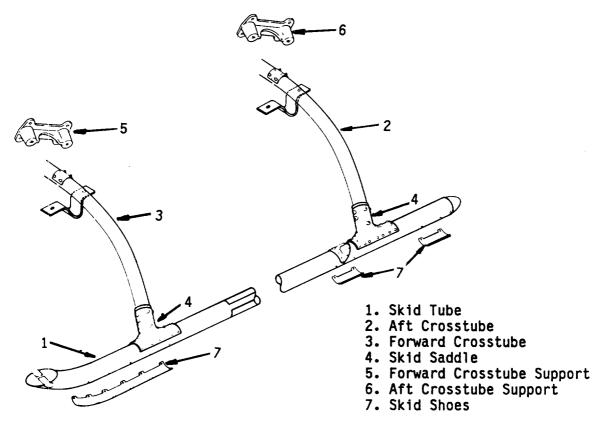


Figure 5-1. Landing Gear and Support Installation

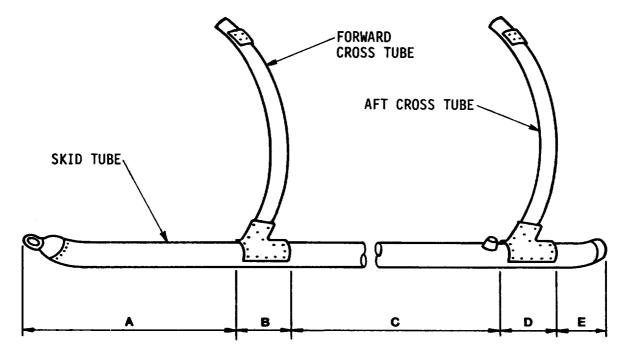
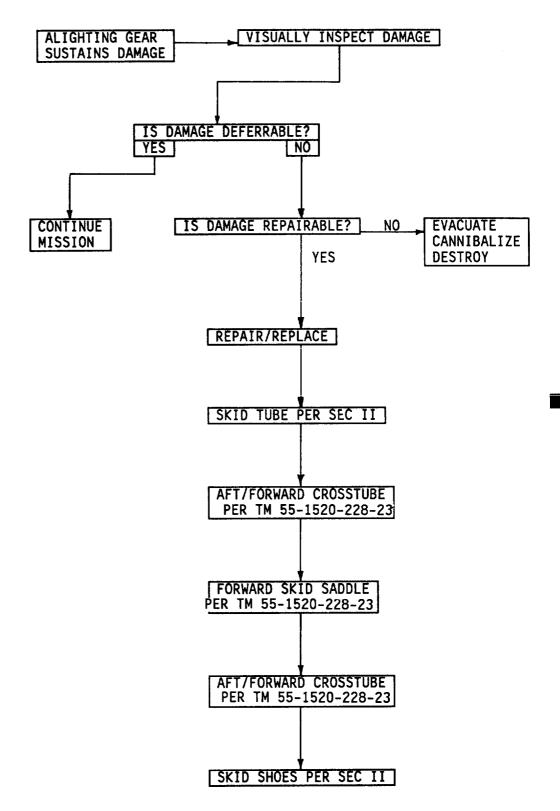


Figure 5-2. Skid Tube Damage Zones

Table 5-1. Assessment Procedure Logic



TM 55-1520-228-BD ALIGHTING GFAR

- c. Visually inspect structures supporting alighting gear attachment points and transmission attachment points for any signs of structural distress such as buckling, cracks, rupture, deformation, popped rivets, or elongated rivet holes. If no such damage is found, replacement of alighting gear may be deferred if it is still functional, and aircraft may be released for fully mission capable flight. Watch for any unusual vibrations in flight. Inspect after every flight until alighting gear can be replaced.
- d. If alighting gear supporting structure is damaged but still functional and the transmission supporting structure shows no damage, release for flight. Watch for any unusual vibrations in flight. Inspect after every flight until structure and alighting gear can be replaced.
- e. If alighting gear or its supporting structure is not functional or the transmission or its supporting structure show any sign of damage, aircraft will be grounded until problem is corrected. This will most likely go beyond scope of BDAR.

Section III. SKID DAMAGE

5-7. SKID DAMAGE.

GENERAL INFORMATION: Landing skids may be damaged by wear or enemy fire. If time is available, repair can be performed to prevent further damage to landing skids.

LIMITATIONS: Use care in landing.

PERSONNEL/TIME REQUIRED:

- •2 Soldiers
- . 2 Hours

MATERI ALS/TOOLS REQUIRED:

- . 0.032 In. Sheet Metal
- . Blind Fasteners (item 36, Appx C)
- •Drill Bit and Motor

PROCEDURAL STEPS:

1. Form plate to fit snug around skid. Drill oversize holes along each edge to match attachment holes in skid tube.

Plate should extend one foot on each side of damaged area. Locate center of plate at center of skid tube, Figure 5-3. If there are no Impediments, the new plate may be installed over the old shoes; otherwise remove shoes. Install plate using 1/4 inch cherry rivets or steel clamps, Figure 5-4. Clamps may be fabricated if not available, Figure 5-5.

NOTE

The aft end of the skid tube is bent up, and a steel plate cannot be formed to follow this contour. Do not extend steel plate beyond start of curvature.

2. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

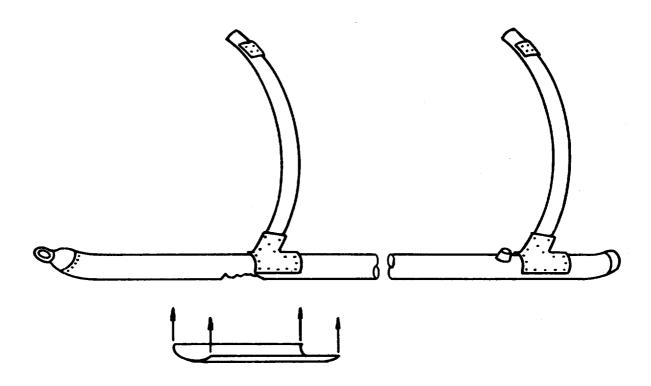


Figure 5-3. Skid Repair

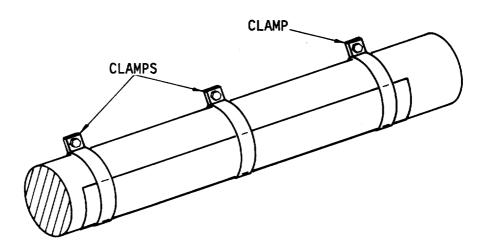


Figure 5-4. Clamp Repair

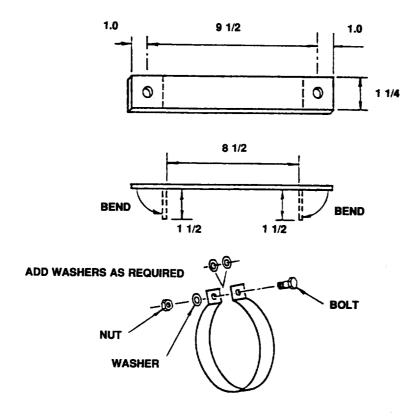


Figure 5-5. Fabricated Clamp

POWER PLANT

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

- 6-1. DESCRIPTION, POWER PLANT. The power plant consists of a T63-A-700 on the OH-58A and a T63-A-720 on the OH-58C mounted between FS120.0 and FS206.0, Figure 6-1. Engine connections are provided for fuel, oil, electrical, instrument, and engine control systems. Major sections of the engine are the air-inlet, compressor, combuster, turbine, and power and accessory gearbox. All BDAR repairs discussed in this chapter are applicable to both engine models.
- 6-2. ASSESSMENT PROCEDURES. Combat damage to the engine usually requires engine replacement. The logic diagram,

Table 6-1, refers to BDAR repair procedures which have been developed.

6-3. REPAIR PROCEDURE INDEX.

	PARA.
Air Bleed Valve Inoperative Double-Check Valve	6-5
Inoperative	6-6 6-7
Oil Lines (Rigid) Type Repair	9-7
Li ne Repair	9-8

Section II. COMPONENT EXPEDIENT FIXES

- 6-4. GENERAL. This section has various expedient fixes which can restore the helicopter's mobility in the event of engine failure. Engine malfunctions can be detected from the following observations:
- a. Abnormal oil pressure, temperature readings, or warning lights.
- b. Abnormal noises or high frequency vibrations.
 - c. Sudden loss of power.

6-5. ALR BLEED VALVE INOPERATIVE.

GENERAL INFORMATION: During engine start-up (or part-speed operation), the compressor is susceptible to surge due to high pressure build-up in the rear stages. An air bleed valve is employed to discharge the high-pressure air in order to alleviate the stall condition. The bleed valve is initially in the open position and senses pressures between the fifth stage and the scroll. Once the stall region is overcome (usually between 65 percent to 75 percent NI) and scroll pressure is reached, the valve is cl osed. Should the valve not close correctly, excess air will be dumped at the compressor and the required burner pressure will not be obtained resulting in engine abort.

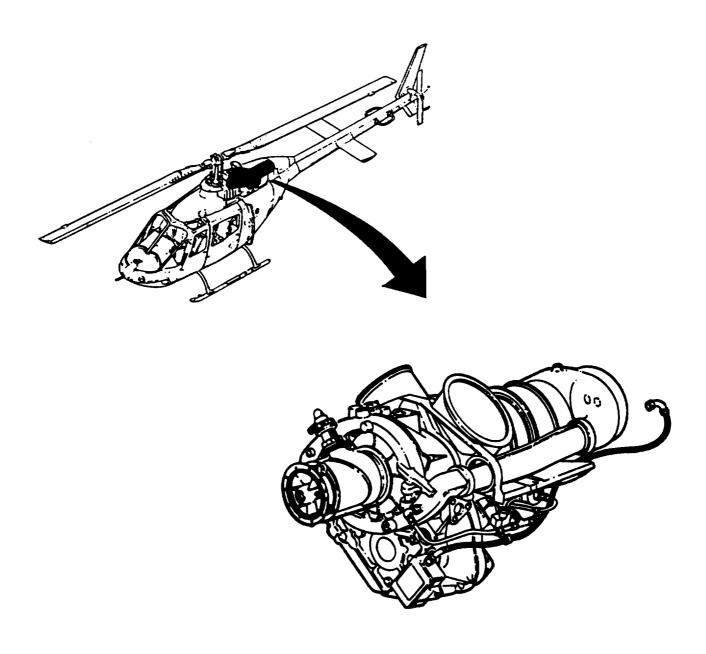
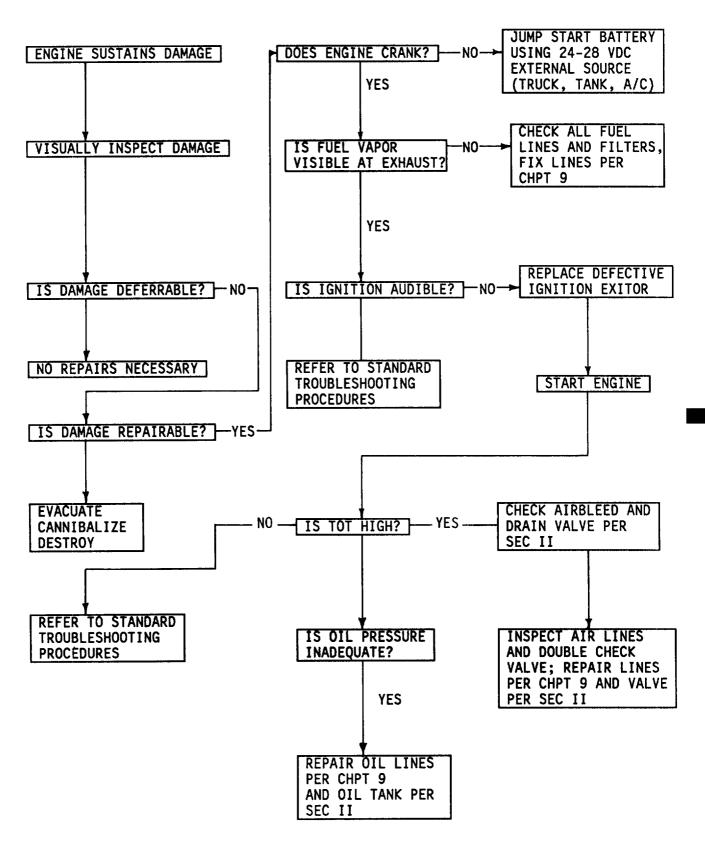


Figure 6-1. T63 Series Engine

Table 6-1. Engine BDAR Assessment Logic



TM 55-1520-228-BD POWER PLANT

LIMITATIONS: Revised engine start procedure.

WARNING

Blocking of the air bleed valve will render the engine highly susceptible to surge which could result in catastrophic damage to the engine.

PERSONNEL/TIME REQUIRED:

I 1 Soldier

. 30 Minutes

MATERIALS/TOOLS REQUIRED: | Sheet Metal, 2 X 3 ln., | Thickness 0.032 I Sheet Metal Snips

PROCEDURAL STEPS:

Manufacture a blocking plate, Figure 6-2.

- Loosen three bolts which secure bleed valve to compressor manifold.
- Slide blocking plate between bleed valve and mounting flange.
- 4. Retighten three bolts which secure bleed valve to compressor manifold.

WARNING

Blocking of air bleed valve could result in catastrophic damage to the engine. The following revisions must be incorporated.

Complete normal engine start procedure except for the following:

NOTE

Bring engine up to 60 percent N1 and hold for a minimum of two minutes. A gradual acceleration is required to avoid a stall condition.

- a. When increasing fuel to the engine, grasp the throttle firmly with both hands and accelerate engine slowly.
- Monitor TOT and N1 gauges for possible stall readings.

NOTE

Stall usually occurs between 65 percent and 75 percent N1.

c. If stall is present, TOT will rise rapidly and N1 RPMs will fluctuate between 65 percent and 75 percent.

WARNING

If gauges indicate a stall is presenť, ďo not overreact. A quick shutdown of engine will decrease N1 RPMs reducing pressure at the inlet causing the fire to come forward through the engine.

d. If gauges indicate stall, hold the throttle firmly. If N1 does not pickup RPM, slowly decrease throttle fuel demand.

WARNING

If stall condition is overcome, engine must now be run in full power operation.

- 6. If engine start is achieved, N1 must be maintained above 80 percent. Reduction to part-speed operation could introduce possible stall implications resulting in engine flameout without auto-relight capability.
- 7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

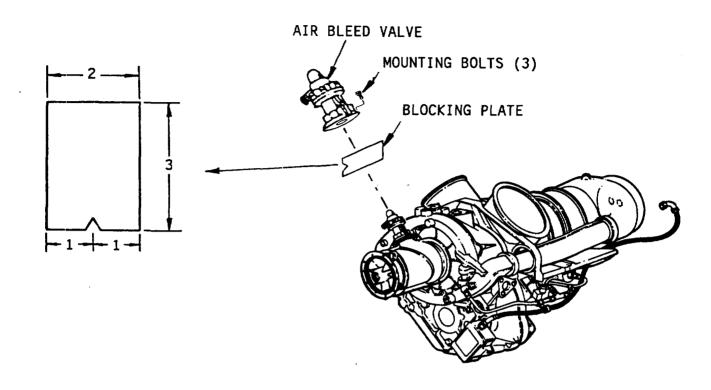


Figure 6-2. Blocking Plate Installation

6-6. DOUBLE-CHECK VALVE INOPERATIVE.

GENERAL INFORMATION: The double-check valve, along with both accumulators, is situated in-line between the power turbine governor and the fuel control, and acts as a dampener for surge control. This system feeds into the fuel control to insure a steady stream of secondary fuel should the compressor flow become inconsistent. It also decelerates a quick reaction from pilot input. With these factors in mind, the pilot must be made aware that if any component of the system is removed or bypassed, any input will result in erratic engine response. At all times, the integrity of all fuel control lines must be maintained. No lines may be deleted or plugged.

NOTE

Should any of the three components sustain damage or otherwise be rendered inoperable, the remaining functional items should be reconnected. In emergency situations, when time is of the essence, the complete system may be bypassed (option 2). This option results in the most unstable condition for the pilot and is therefore least desirable.

OPTION 1: Remove Defective Component.

LIMITATIONS: Erratic engine response.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 30 Minutes

TM 55-1520-228-BD POWER PLANT

MATERI ALS/TOOLS REQUIRED:

. Flex Line Tubing (ID 0.25 In.,
 Length 12 in. min)
. No. 4 Fittings

PROCEDURAL STEPS:

- 1. All connections and fittings throughout the system incorporate the same thread pattern and therefore a variety of configurations may be achieved. Should the system be inoperable, remove only the defective component(s) and reconstruct the system. Refer to Figure 6-3 to determine possible alternatives.
- 2. Reuse existing o-rings when possible. If o-rings are severely damaged, scavenge off removed component.

CAUTION

All fuel control lines must be maintained. No lines may be deleted or plugged.

- 3. Insure the lines between the fuel control and the governor are intact and not leaking.
- 4. If any leakage is incurred due to the above procedure and cannot be corrected or if time constraints take precedent, the system may be bypassed as a last resort, refer to option 2.

OPTION 2: Bypass Entire System.

LIMITATIONS: Erratic flight control.

NOTE

The pilot must be made aware that any fuel demand he places on the engine will be reacted upon immediately leading to quick engine response and erratic flight control.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 15 Minutes

MATERIALS/TOOLS REQUIRED:

- . Flex Line Tubing (ID 0.25 in., Length 12 in. rein)
- . No. 4 Fittings
- 1. Refer to Figure 6-3(b) to establish bypass configuration.
- 2. Disconnect clamp from flexible hose and extend flexible hose to rigid hose.
- 3. Use fitting from either hose and connect the two hoses.
- 4. Insure both o-rings are reusable and no leakage exists. If either o-ring is damaged, scavenge from bypassed components.

6-7. OIL TANK PUNCTURED.

GENERAL INFORMATION: The engine will seize in a matter of minutes if run without oil. This procedure lists six methods to fix a leaking oil tank, depending on the size of the leak and the materials available. If fuel cell repair kit is available, utilize its contents.

LIMITATIONS: None.

NOTE

Some repairs may come loose due to heat and vibration.

OPTION 1: Wood Plug (for Smooth Round Holes).

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 30 Minutes

MATERIALS/TOOLS REQUIRED:

- . Plug, Wooden
- . Hose or Tubing

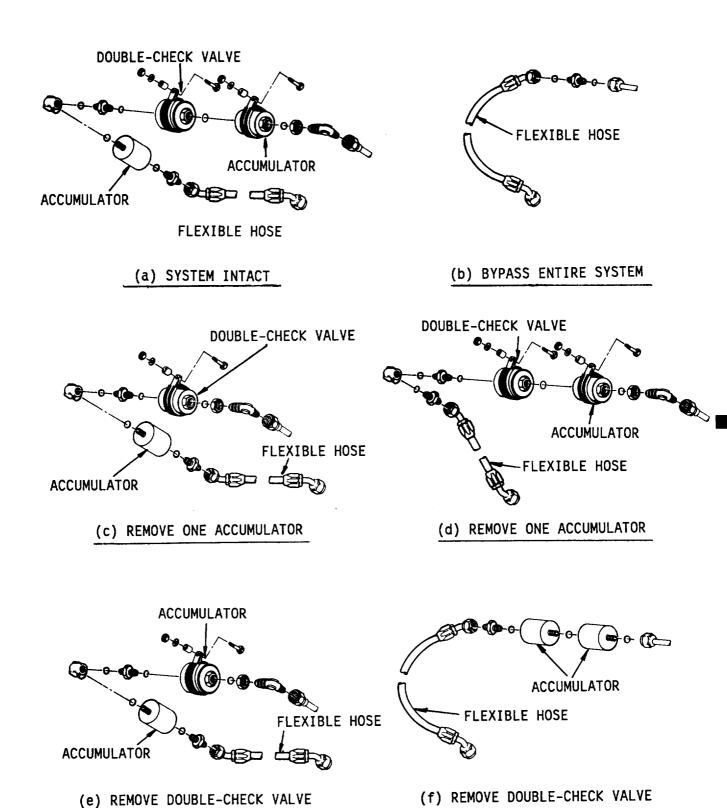


Figure 6-3. Double-Check Valve System, Possible Alternatives

TM 55-1520-228-BD POWER PLANT

PROCEDURAL STEPS:

- 1. Obtain a small piece of hose or tubing and insert the piece into the hole on the oil tank, Figure 6-4.
- 2. Insert a tapered wooden plug inside the hose or tubing (wooden plug should be checked periodically and retightened if necessary).
- 3. Replenish oil supply.
- 4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

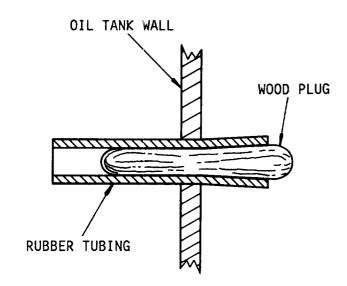


Figure 6-4. Wood Plug

OPTION 2: Duct Tape (for thin cracks).

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 30 Minutes

MATERI ALS/TOOLS REQUIRED:

- . Tape, Fiberglass or Duct (item 51, Appx C)
- . Solvent, Naptha (item 7, Appx C) or Equivalent

PROCEDURAL STEPS:

- 1. Clean area around crack with solvent to remove the oil.
- 2. Seal crack with tape.
- 3. Replenish oil supply.
- 4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 3: Sealant (for small holes)

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 1 Hour

MATERIALS/TOOLS REQUIRED:

- . Solvent, Naptha (item 7, Appx C) or Equivalent
- . Sealant, Silicon (item 4, Appx C) or Equivalent
- . Wood Plug

PROCEDURAL STEPS:

- 1. Clean area around hole with solvent to remove all traces of oil so sealant will stick.
- 2. Fill hole and surrounding area with sealant.
- 3. If hole is large enough, use wood plug as a filler while filling hole with sealant, Figure 6-5.
- 4. After seal ant has dried, replenish oil supply.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

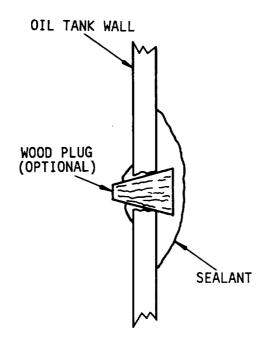


Figure 6-5. Sealant for Small Holes

OPTION 4: Screw, Washer, and Gasket (for small holes)

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 30 Minutes

MATERI ALS/TOOLS REQUIRED:

- Screw, Sheet MetalGasket Material (item 20, Appx C)
- Washer

PROCEDURAL STEPS:

- 1. Cut a piece of gasket material that will overlap the hole by about 1 Inch from the center of the hole.
- 2. Pierce a small hole in the center of the gasket material.
- 3. Using the sheet metal screw and washer, screw the gasket material through the pierced hole and through the small hole on the oil tank onto the oil tank wall to stop the leak, Figure 6-6.

- Replenish oil supply.
- Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures

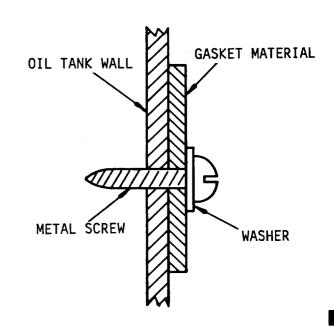


Figure 6-6. Repair Using Screw, Washer and Gasket

OPTION 5: Hose Assembly, Sealant, Nut and Bolt.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 2 Hours

MATERIALS/TOOLS REQUIRED:

- Nut, Bolt, and Washer
 Sealant, Silicon (item 4, Appx C)
 or Equivalent
- . Hose or Tubing
- Solvent, Naptha (item 7, Appx C) or Equivalent

PROCEDURAL STEPS:

1. Clean area around hole with solvent to remove all traces of oil so sealant will stick.

- 2. Use a piece of hose/tubing about the same diameter of the hole. Assemble bolt, hose/tubing, washer, and nut, Figure 6-7. Apply sealant to all edges. Start nut on bolt and tubing until assembly is snug.
- 3. File edge of hole until round and smooth. Push hose assembly about half-way through hole. Tighten-nut on bolt expand hose to seal hole. If necessary, remove oil tank plate to allow a wrench or pliers inside of oil tank to hold nut while turning bolt.
- 4. If oil tank plate was removed, reinstall.
- 5. After seal ant has dried, replenish oil supply.
- 6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

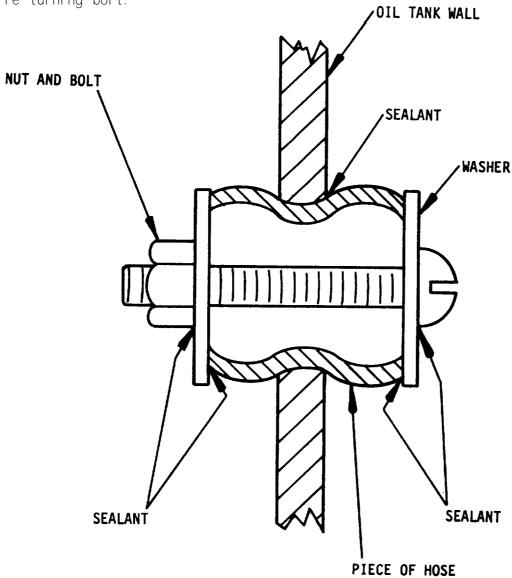


Figure 6-7. Hose Assembly, Sealant, Nut, and Bolt

OPTION 6: Sheet Metal with Sealant and/or Blind Rivets (for large holes).

PERSONNEL/TIME REQUIRED:

- . 2 Soldiers . 3 Hours

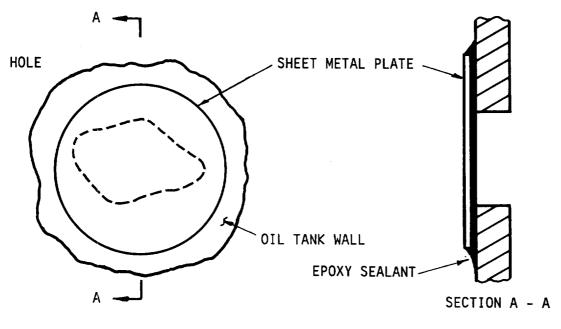
MATERIALS/TOOLS REQUIRED:

- . Sheet Metal
- . Sealant, Silicon (item 4, Appx C) or Equivalent
- . Blind Rivets or Sheet Metal Screws (item 39, Appx C)
- Solvent, Naptha (item 7, Appx C) or Equivalent
- . Gasket Material (item 20, Appx C)

PROCEDURAL STEPS:

1. Cut a piece of sheet metal that will overlap the hole by 1-1/2 inches at all points, Figure 6-8.

- 2. If sealant is to be used, clean area around hole with solvent so sealant will stick.
- 3. Put sealant or gasket material over hole. Put sheet metal plate over hole and secure with sheet metal screws or blind rivets.
- 4. After seal ant has dried, replenish oil supply.
- Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.



SHEET METAL PLATE WITH EPOXY

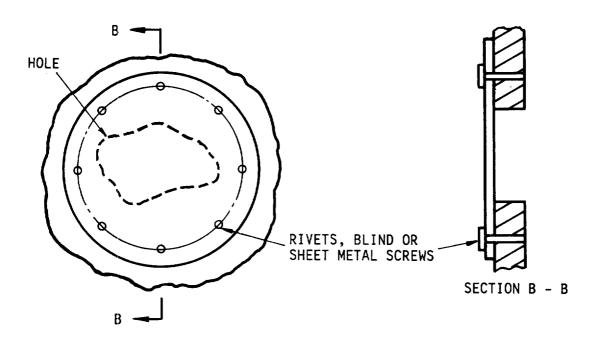


Figure 6-8. Sheet Metal Plate with Sealant and/or Cherry Rivets

ROTORS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

Section 1. INTRODUCTION

- 7-1. SCOPE. This chapter contains the fault assessment and expedient repair procedures available to find and fix battlefield damage to the main and tail rotor blades.
- 7-2. GENERAL. The system consisting of two blade assemblies, each with two blades, a central hub, and a control mechanism. The main rotor is driven by the mast which is connected to the transmission and provides for fore, aft, lateral, and vertical flight modes. The tail rotor is driven by the tail rotor gearbox and provides for directional control. See Figures 7-1 and 7-2 for system configuration. Assessment procedures are found in Table 7-1.
- 7-3. ASSESSMENT PROCEDURES. Refer to Table 7-1.
- 7-4. REPAIR PROCEDURE INDEX.

	PARA.
Rotor Blade, Hole 1 Inch Diameter or Less Main Rotor Blade, Hole 1 to 4 Inches Diameter Maximum	

Section II. REPAIRS

- 7-5. GENERAL. The rotor system does not lend itself well to limited repairs. In most instances, the only repair options for a faulty component will be to replace or repair by normal procedures. Those limited repairs which have been developed are listed in this section.
- 7-6. ROTOR BLADE, HOLE 1 INCH DIAMETER OR LESS.
- GENERAL INFORMATION: A small hole passing through the honeycomb core area, Figure 7-3, on either a main or tail rotor blade can be repaired with duct tape. Removal of blade is not necessary.

LIMITATIONS: Adjustment of blade balance may be required after repair. Inspection of repaired area after each flight would be required.

PERSONNEL/TIME REQUIRED:

- . 2 Soldiers
- . 15 Minutes

MATERIALS/TOOLS REQUIRED:

- Army Green 3 Inch Tape or Aluminized Tape (item 50, Appx C)
- . Cleaning Solvent (item 7, Appx C)

PROCEDURAL STEPS:

1. Position blades for access to damaged area. Support blades to prevent movement and droop.

TM 55-1520-228-BD ROTORS

Pitch Link
 Lever
 Blade Latch
 Blade Assy
 Idler Link
 Retaining Bolt
 Swashplate Assy
 Grip
 Link
 Mast Nut
 Collective Lever
 Hub Assy (Oil Lubricated shown)
 Inner Ring
 Outer Ring
 Mast



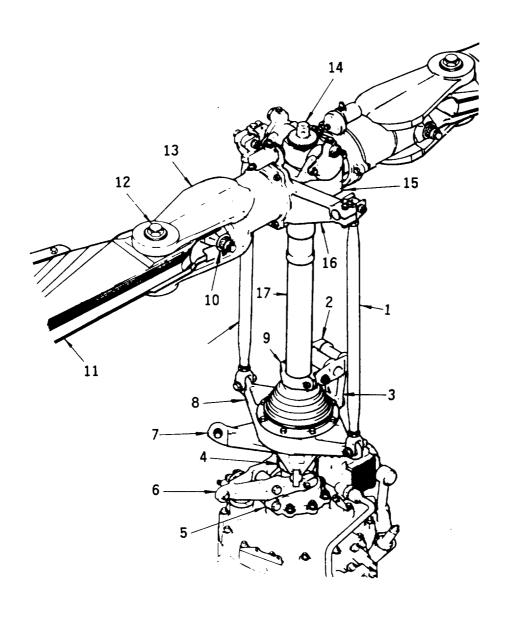


Figure 7-1. Main Rotor System

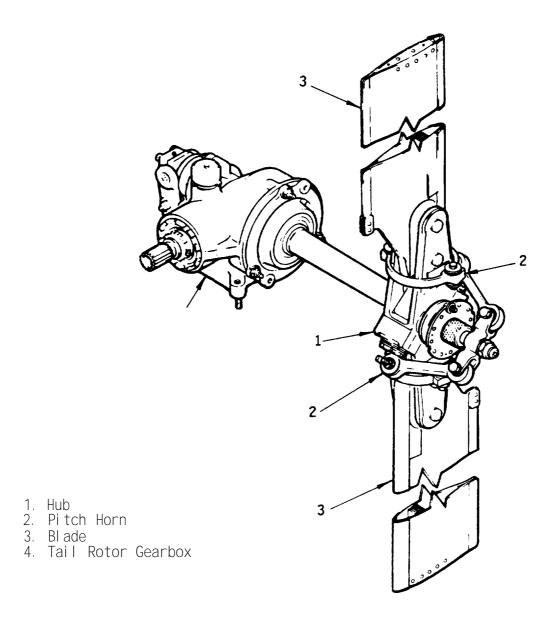
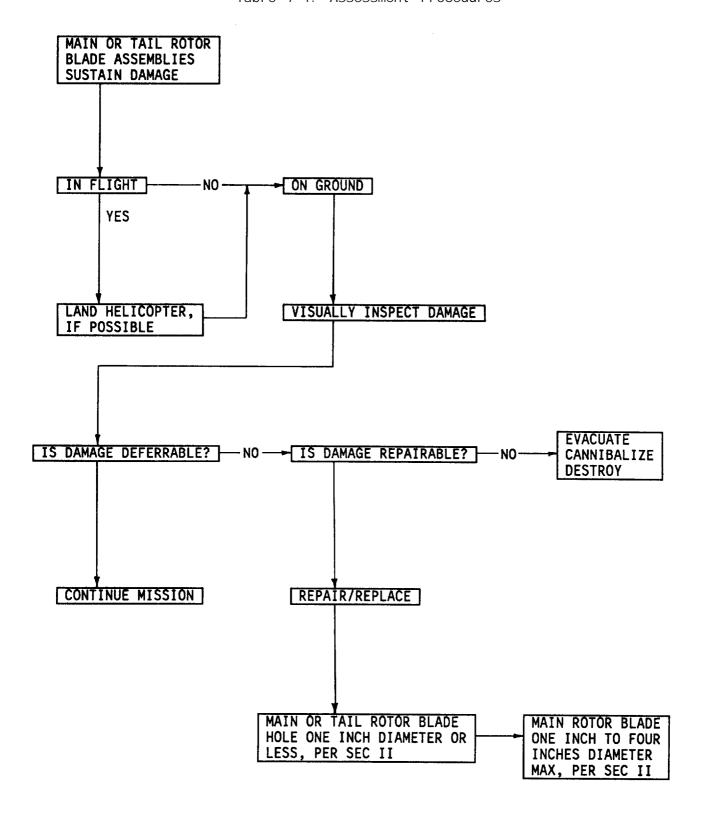
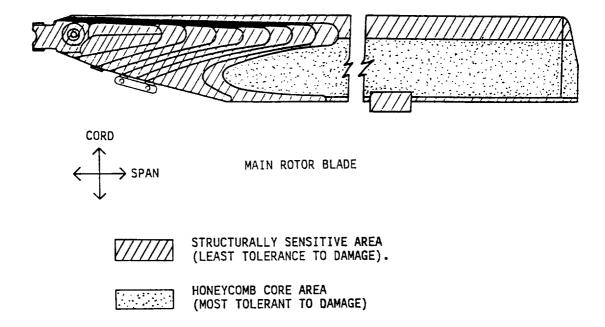
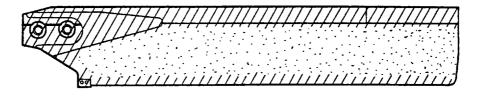


Figure 7-2. Tail Rotor System

Table 7-1. Assessment Procedures







TAIL ROTOR BLADE

Figure 7-3. Rotor Blades, Damage Sensitive Areas

TM 55-1520-228-BD ROTORS

- 2. Smooth damage; remove all rough edges.
- 3. Clean area around damage and completely around blade where tape Is to be applied.
- 4. Cover hole with a chordwise layer of tape, top and bottom of blade. Extend ends of tape 2 inches beyond area of damage, Figure 7-4.
- 5. Wrap a second layer of tape chordwise over the first layer and around the entire blade. Overlap ends by 3 inches with outside edge of top toward trailing edge.
- 6. Wrap exact number of tape wraps on opposite side at approximately same span location.
- 7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

7-7. MAIN ROTOR BLADE, HOLE 1 TO 4 INCHES DIAMETER MAXIMUM.

GENERAL INFORMATION: A medium size hole in the honeycomb core area, Figure 7-3, of a main rotor blade can be temporarily repaired by fashioning a patch using aluminum foil as a plugging material. Removal of blade is not necessary. This repair is limited to certain areas of the blade as shown in Figure 7-5.

LIMITATIONS: Adjustment of blade balance may be required after repair. Inspection of repaired area after each flight would be required.

PERSONNEL/TIME REQUIRED:

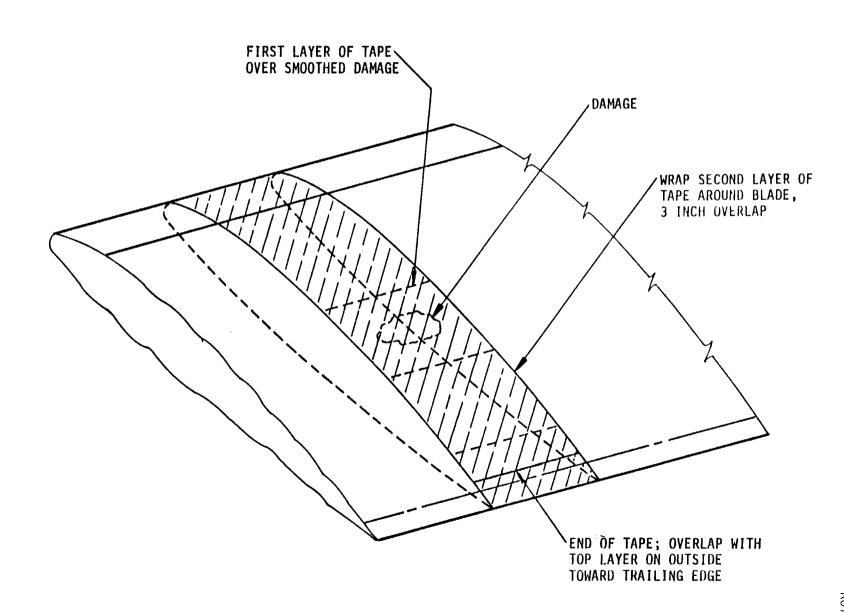
- . 2 Soldiers
- . 1 Hour

MATERIALS/TOOLS REQUIRED:

- Army Green Tape, Maximum Width
 Available; 3 Inches Minimum or
 Aluminized Tape (item 50, Appx C)
- . Fiberglass or Álumínum Wafers
- . Aluminum Foil or Other Filler Material (item 18, Appx C)
- . Adhesi ve Package

PROCEDURAL STEPS:

- 1. Position blades for access to damage area. Support blades to prevent movement and droop.
- 2. Smooth damage; remove all rough edges.
- 3. Clean area around damage and completely around blade where tape is to be applied.
- 4. Make a plug of crushed aluminum foil or other filler material shaped to fit in the hole. Do not make the plug too dense; voids should be about 1/4 inch. Apply spots of adhesive to the aluminum sheet before crushing so plug will have some strength. Apply adhesive sparsely to the finished plug In the area where it will come in contact with the blade sandwich material.
- 5. Insert plug in hole. Hole should be well packed,
- 6. Cut out a fiberglass or aluminum wafer so it just fits over the hole without overlapping the external blade skin. Apply adhesive to the bottom of the wafer where it comes in contact with the aluminum plug, and close the hole.
- 7. Cover hole with Army green tape. Tape should extend 2 inches beyond edge of the hole, Figure 7-4.



- 8. Wrap a layer of tape around the entire blade and over the repaired area.
- 9. Wrap exact number of tape wraps on opposite side at approximately same span location.
- 10. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

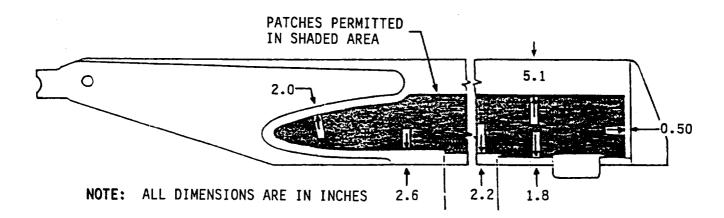


Figure 7-5. Repair Areas - Main Rotor Blades

DRIVE TRAIN SYSTEM

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

- 8-1. GENERAL. The drive train is a system of shafts and gearboxes through which the engine drives the main rotor, tail rotor, and such accessories as rotor tachometer generator and hydraulic pump. (See Figure 8-1 for drive train system configuration.)
- 8-2. DRIVE TRAIN DAMAGE. The drive train system does not lend itself well to limited repairs. In most instances, the only repair options for a faulty component will be to replace or repair by normal procedures. Those limited repairs which have been developed are listed in this section.
- 8-3. ASSESSMENT PROCEDURES. Refer to Table 8-1.

8-4. REPAIR PROCEDURES INDEX.

	<u>PARA</u> .
Drive Train Damage	8-2 8-5
Transmission Oil Cooling Air Duct Repair	8-6
Oil Pressure Transmitter Leak Low Pressure Sensing Switch Oil Hoses and Lines, Leaks	8-7 8-8
or Restrictions	
Damage	8-11

Section 11. REPAIR

- 8-5. SENSITIVITY OF DRIVE TRAIN SYSTEM TO BATTLEFIELD DAMAGE. The drive train system includes a number of components which, if damaged or deformed (bent) in any way or fail internally, will render the system inoperable or severely degrade flight characteristics or safety. The system is particularly sensitive to any damage which adversely affects any of the following:
- a. Internal operation of transmission, freewheeling assembly, or tail rotor gearbox.
- b. Operation of the transmission oil system.

c. Straightness, original shape, or integrity of either the mast, drive-shafts, or output shaft at tail rotor gearbox.

8-6. AIR DUCT HOSE DAMAGE.

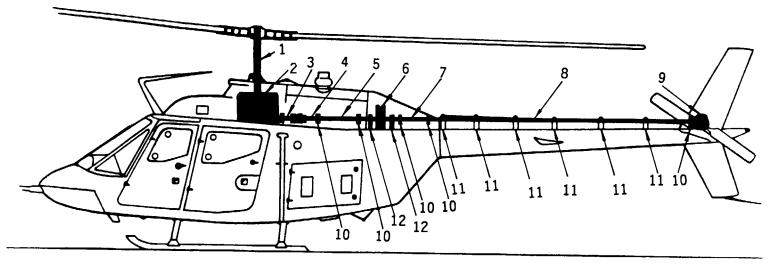
GENERAL INFORMATION: Holes, tears, or distortions in air duct hose (16, Figure 8-2) can result in less than the required amount of cooling air reaching the oil cooler (2, Figure 8-2). This condition may cause the transmission oil system to operate at above normal temperature. Several repairs can be applied depending on accessibility and the nature and extent of damage incurred. Various repairs are shown at Figure 8-3.

- 1. Mast
- Transmission Assy
 Main Driveshaft

- 4. Freewheeling Assy5. Forward Short Tail Rotor Dri veshaft
- 6. Oil Cooling Blower and
- Shaft Assy 7. Aft Short Tail Rotor Driveshaft
- 8. Long Tail Rotor Driveshaft 9. Tail Rotor Gearbox Assy

- 10. Disc Assy
- 11. Bearing Hangar and Support Bracket

- 12. Hangar (Blower Assy)
 13. Oil Cooler
 14. Coupling (Main Driveshaft)
 15. Splined Adapter
 16. Oil Filter Assy
 17. Tail Rotor Driveshaft
 Segment



SEE DETAIL A

(PRIOR TO COMPLIANCE WITH MWO 55-1520-228-50-25!

Figure 8-1. Drive Train System (Sheet 1 of 4)

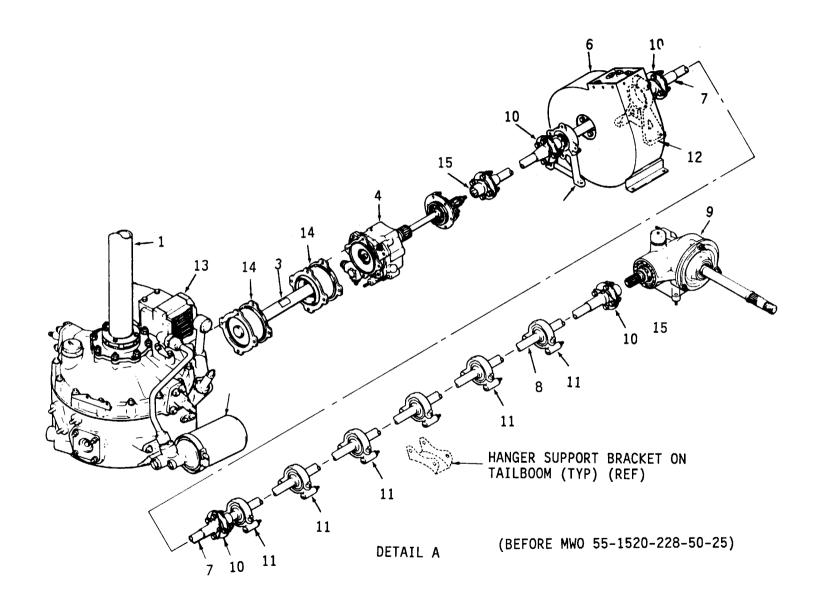
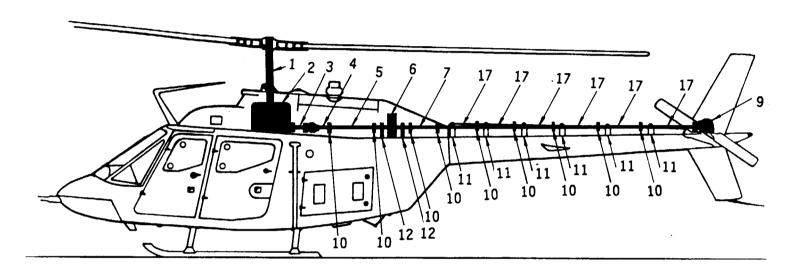


Figure 8-1. Drive Train System (Sheet 2 of 4)

Figure 8-1. Drive Train System (Sheet 3 of 4)



(AFTER COMPLIANCE WITH MWO 55-1520-228-50-25)

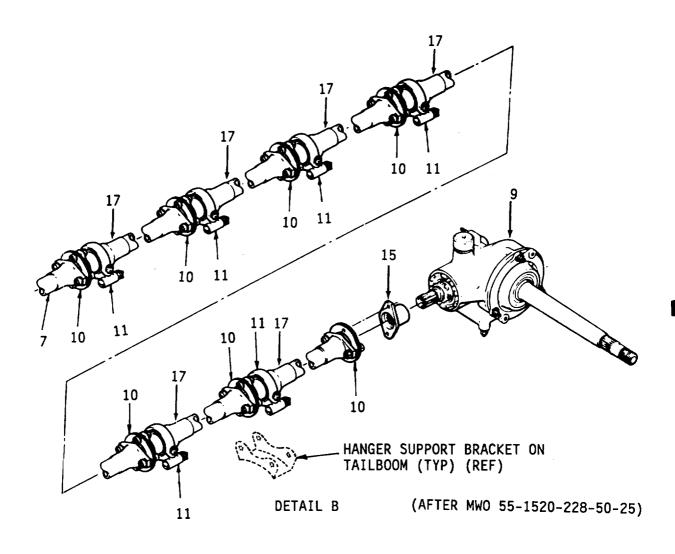
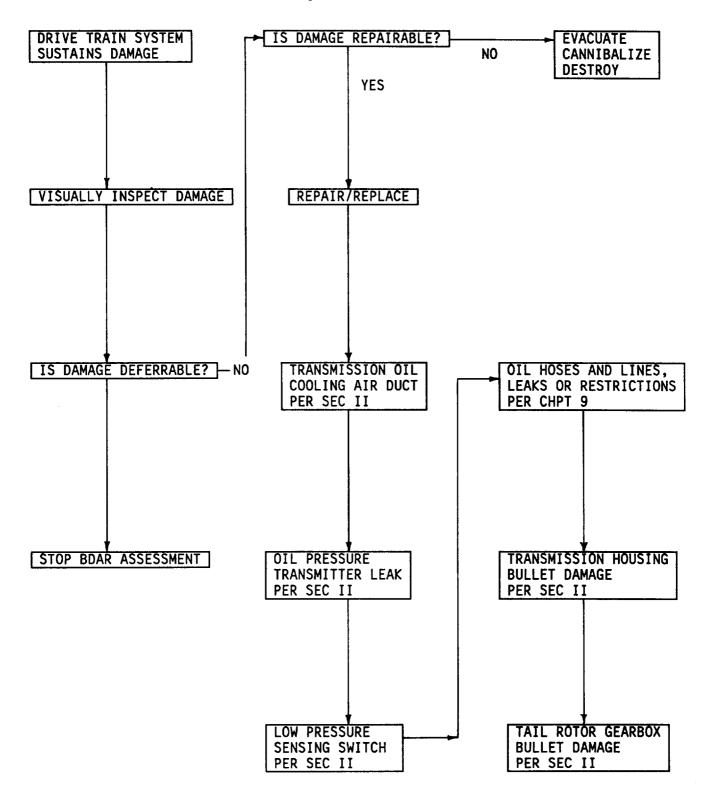


Figure 8-1. Drive Train System (Sheet 4 of 4)

Table 8-1. Drive Train System BDAR Assessment Procedures



LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 20 Minutes

MATERIALS/TOOLS REQUIRED:

- . Pliers
- . Duct Tape (item 51, Appx C)
- . Wire Cutters
- . Thin Pliable Material

PROCEDURAL STEPS: (Refer to Figure 8-3, Repairs A, B, C, D.)

- 1. Hole or tear in fabric. Wrap several turns around duct to cover hole or tear. Tape should extend beyond damaged area 1 to 2 inches in each direction. Refer to repair A.
- 2. Distorted duct.
- a. Using pliers and wire cutters, reshape or cut away the portion of duct which would create an air flow restriction or which is badly distorted. Note: If wire frame work below fabric is cut through, refer to step 3, severed duct.
- b. If repair area is not at a bend portion of duct routing, a repair can be applied as shown at either repair B or c. If repair area is located at a bend portion of duct routing, a repair can be applied as shown at repair B.
- c. Tape should extend beyond damaged area 1 to 2 inches in either direction.
- 3. Severed duct.
- a. Using pliers and wire cutters, reshape or cut away any portion of duct which would create an air flow restriction or which is badly distorted.
- b. If area to be repaired is not in a bend portion of duct routing, a repair can be applied as shown at either repair B, C, or D. If area to be repaired is in a bend portion of duct routing, a repair can be applied as shown at either repair B or D.

- c. Tape should extend beyond damaged area 1 to 2 inches in either direction.
- 4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

8-7. OIL PRESSURE TRANSMITTER C LEAK.

CAUTI ON

If 8-7 and 8-8 repairs are accomplished, there will be no Oil Pressure Monitoring System.

GENERAL INFORMATION: If oil is being lost due to damage at oil pressure transmitter (7, Figure 8-2), the transmitter can be removed and replaced with a threaded plug provided XMSN OIL PRESS warning light is operable and considered reliable.

LIMITATIONS: Early warning of high oil pressure conditions would be eliminated since the transmission oil gauge would be rendered inoperable. XSMN OIL PRESS warning light would give early warning but for low pressure conditions only.

PERSONNEL/TIME REQUIRED:

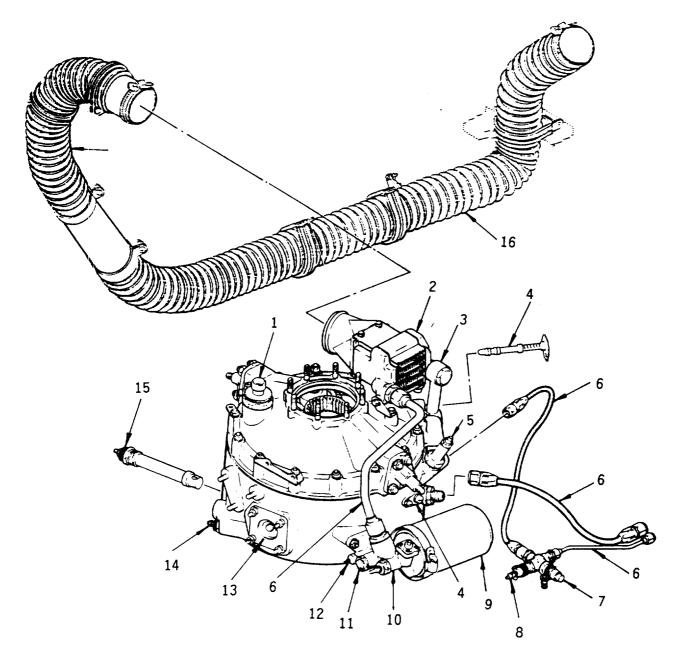
- . 1 Soldier
- . 15 Minutes

MATERIALS/TOOLS REQUIRED:

- . Pliers
- . Open End Wrench
- . Tie Wraps
- . Plug, MS24391D4L (same as 7, Figure 8-2 A)

PROCEDURAL STEPS: (Refer to Figure 6-2.)

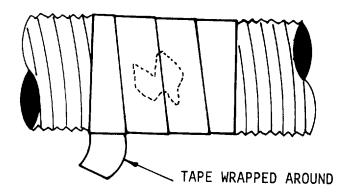
- 1. Cut lock wire at transmitter (7).
- 2. Remove electrical connector from transmitter (7).
- 3. Remove transmitter (7) and packing. Retain packing.



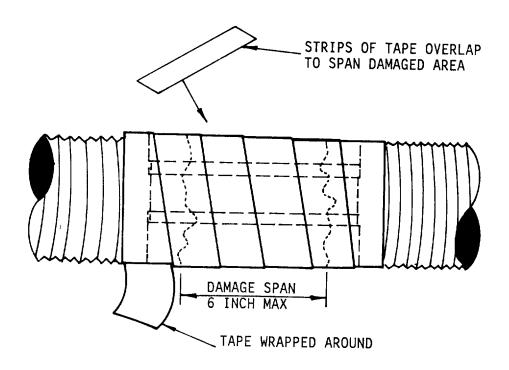
- 1. Filler Cap
- 2. Oil Cooler
- 3. Transfer Tube 4. Nozzle (Jet)
- 5. Pressure Regulating Valve
- 6. Hoses and Lines
- 7. Oil Pressure Transmitter C PlugA
- 8. Low Pressure Sensing Switch

- 9. Oil Filter
- 10. Oil Filter Head Assy
- 11. Filter Bypass Valve12. Oil Temperature Switch
- 13. Oil Pump
- 14. Chip Detector
- 15. Chip Detector 16. Air Duct Hoses

Figure 8-2. External Components - Transmission Oil System



REPAIR A



REPAIR B

Figure 8-3. Flex Duct Repair (Sheet 1 of 2)

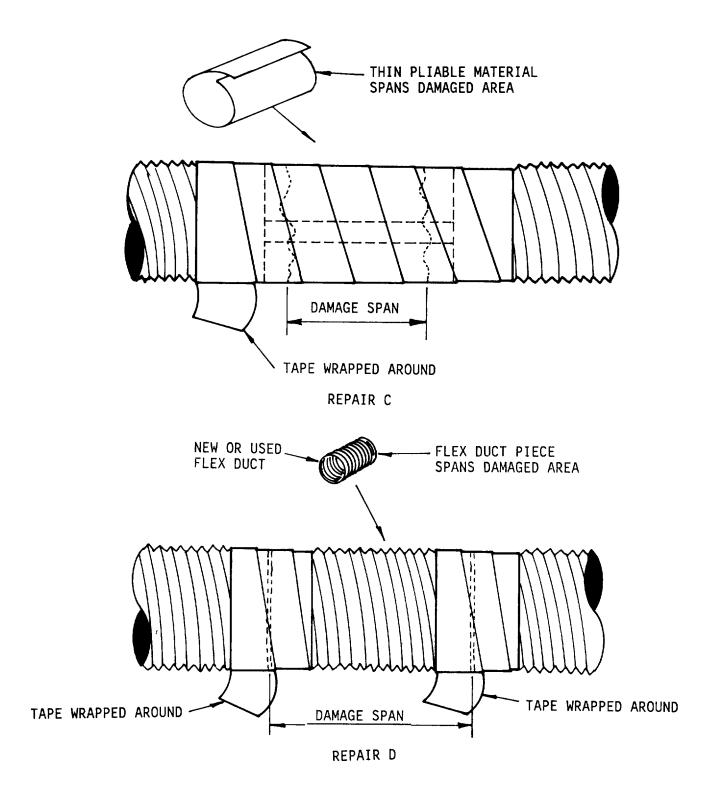


Figure 8-3. Flex Duct Repair (Sheet 2 of 2)

- Install plug and packing where transmitter (7) was previously installed.
- Secure Loose electrical connector and cable with tie wraps.
- Check for leaks.
- Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.
- 8-8. LOW PRESSURE SENSING SWITCH C LEAK.

GENERAL INFORMATION: If oil is being lost due to damage at low pressure sensing switch (8, Figure 8-2), the switch can be removed and replaced with a threaded plug, provided the transmission oil pressure gauge is operable and reliable.

XMSN OIL PRESS warning LIMITATIONS: light would be inoperable. Only the transmission oil pressure gauge would monitor transmission oil pressure.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 15 Minutes

MATERIALS/TOOLS REQUIRED:

- . Pliers
- Tie Wraps
- Open End Wrench
- Plug, MS 24391D4L (same as 7, Figure 8-2 **A**)

PROCEDURAL STEPS: (Refer to Figure 8-2.) . 1 Soldier

- Cut lock wire. 1.
- Remove electrical connector from switch (8).
- Remove switch (8) and packing. Retain packing.

- 4. Install plug and packing where switch (8) was previously installed.
- Secure Loose electrical connector and cable with tie wraps.
- Check for Leaks.
- Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.
- 8-9. OIL HOSES AND LINES, LEAK OR RESTRICTION (CRIMP).

GENERAL INFORMATION: Damaged oil hoses and lines (6, Figure 8-2) of the transmission oil system may be repaired by manufacturing a new hose or line or by installing a replacement section for the damaged section. Similar repairs are outlined at Chapter 9, Section II, and may be utilized for the transmission oil system.

8-10. TRANSMISSION-BULLET DAMAGE.

GENERAL INFORMATION: If the transmission is hit by a bullet which exits on the opposite side, the transmission does not bind and there is no oil loss, repair may be deferred. Aircraft is fully flight capable. Other repairs that may be utilized for the transmission can be found in Chapter 6, Section II.

Small oil loss can be LIMITATIONS: tolerated. Inspect after every flight.

PERSONNEL/TIME REQUIRED:

- . 15 Minutes

MATERIALS/TOOLS REQUIRED:

- Solvent, Cleaner (item 7, Appx C)
- Tape, Army Green (Item 50, Appx C) or Equivalent
- Pl ua
- Safety Wire (item 26, Appx C)

TM 55-1520-228-BD DRIVE TRAIN SYSTEM

PROCEDURAL STEPS:

- 1. Clean damaged area with solvent.
- 2. Close bullet hole with a plug and hold in place with tape.
- 3. Secure plug in place with safety wire.

NOTE

Because transmission is pressurized, try to center safety wire over plug.

- 4. Fill transmission with oil.
- 5. Inspect after every flight.
- 6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.
- 8-11. TAIL ROTOR GEARBOX, BULLET DAMAGE.

GENERAL INFORMATION: If a bullet strikes the gearbox and exits and the gears do not jam, bind, or lose lubricant, repair may be deferred.

LIMITATIONS: Small oil loss can be tolerated. If aircraft is run for an extended period of time with little or no oil, gearbox will jam.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 15 Minutes

MATERIALS/TOOLS REQUIRED:

- . Solvent, Cleaner (item 7, Appx C)
- . Rubber Sheet
- . Tape, Army Green (item 50, Appx C) or Equivalent
- . Sealant (item 4, Appx C)

- 1. Clean damaged area with solvent if available. Place a rubber sheet 1/2 inch to 3/4 inch larger than hole under green tape. Alternatively, if rubber sheet not available, place sealant under tape.
- 2. Close bullet hole with green Army tape.
- Inspect after every flight.
- 4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

CHAPTER 9

HYDRAULI C

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

- 9-1. SCOPE. The OH-58 hydraulic system operates at pressures of 575 to 625 psi. This pressure is produced by the hydraulic pump (9, Figure 9-1). The hydraulic fluid is routed to the flight control servo actuators by means of flex hoses, tubes, mechanical valves, and an electrically controlled solenoid.
- 9-2. GENERAL. This chapter contains field fixes applicable only to the hoses and tubing which the hydraulic system utilizes. Refer to Figure 9-2 for system fluid distribution.
- 9-3. ASSESSMENT PROCEDURES. No assessment procedures are needed to locate leaks and ruptured hoses and

lines. The location of a leak can only be determined by visual examination. Refer to Table 9-1 for assessment logic of the hydraulic system.

9-4. REPAIR PROCEDURE INDEX.

PARA.

Lines and Hose Replacement 9	7-5
Tube Cutting	9-6
	9-7
Hydraulic Hose Damage	9-8
0-Ring, Packing, and Gasket	
Application	9-10
	9-11

Section II. LINES AND HOSES

9-5. GENERAL.

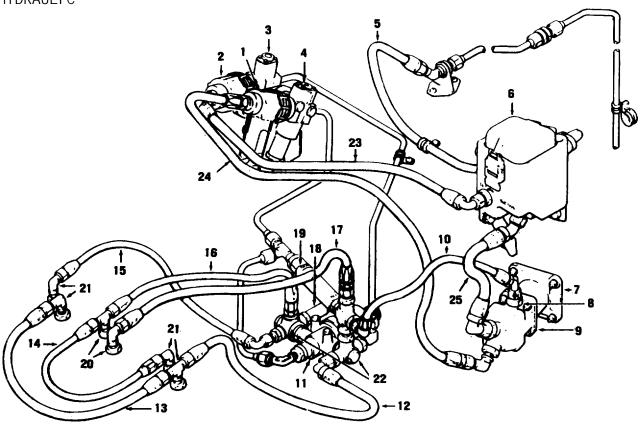
a. Replacement lines may be manufactured in the field if materials and tools are available.

NOTE

Never discard MS fittings, they are reusable. The MS21922 sleeve is not reusable.

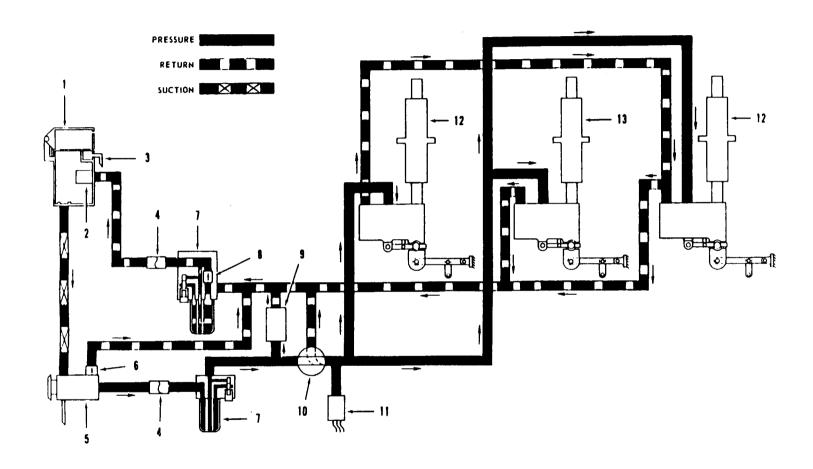
b. Replacement lines and hoses need not be routed along the path of the original installation. They may be routed along any convenient path as long as they do not interfere with personnel or with operating equipment. Long lines and hoses should be clamped to hard supports at convenient intervals not exceeding 24 inches.

- c. It is considered quicker to make a replacement hose, using the old fitting if serviceable, than to repair a damaged hose. Flexible hose of braided stainless steel with rubber center is used. There are two types of fittings used. One fitting is a socket and nipple assembly, Figure 9-3. The other type is a nipple, o-ring, sleeve and socket, Figure 9-4.
- 9-6. TUBE CUTTING. When cutting tubing, it is of utmost importance to produce a squared end free of burrs. Tubing may be cut with a tube cutter or a hacksaw. The tube cutter is adaptable for use with any metal tubing such as steel, titanium, or aluminum alloy. Place tubing in the cutting tool with the cutting wheel at the point where the cut is to be made, Figure 9-5.



- 1. Quick Disconnect (Pressure)
- 2. Quick Disconnect (Return)
- 3. Filter (Return)
- 4. Filter (Pressure)
- 5. Vent Line
- 6. Reservoir
- 7. Tachometer Generator
- 8. Check Valve
- 9. Hydraulic Pump
- 10. Case Drain Hose
- 11. Solenoid Valve
- 12. Hose (Return) 13. Hose (Return)

- 14. Hose (Pressure)
- 15. Hose (Pressure
- 16. Hose (Pressure)
- 17. Hose (Return)
- 18. pressure Switch
- 19. Relief Valve
- 20. To Servo Actuator (Collective)
- 21. To Servo Actuator (Cycilc)
- 22. Solenoid Valve Tee Fitting
- 23. Hose Filter (Return)
- 24. Hose Filter (Pressure)
- 25. Hose, Pump inlet



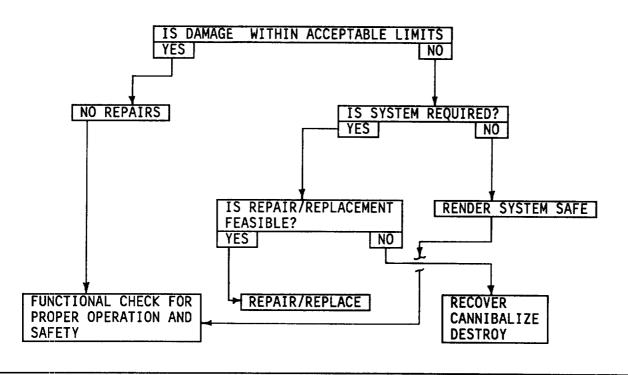
- 1. Reservoi r
- 2. Baffle

- 8. Filter Bypass Valve9. Relief Valve

- 2. Baffle
 3. Scupper Drain
 4. Qui ck Di sconnects
 5. Pump
 6. Check Val ve
 7. Filter
 10. Sol enoi di vai ve
 11. Pressure Switch
 12. Servo Actuator, Cyclic
 13. Servo Actuator,
 Collective

Figure 9-2. Hydraulic System Schematic

Table 9-1. Assessment Logic



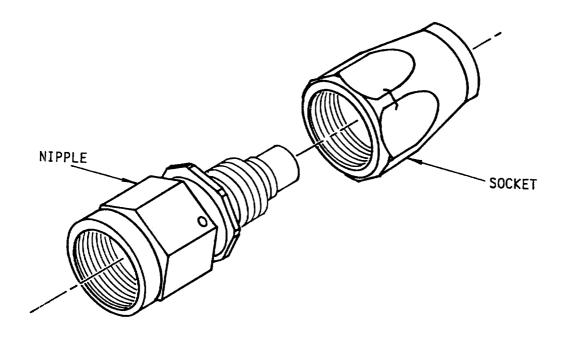


Figure 9-3. Two-Part Fitting

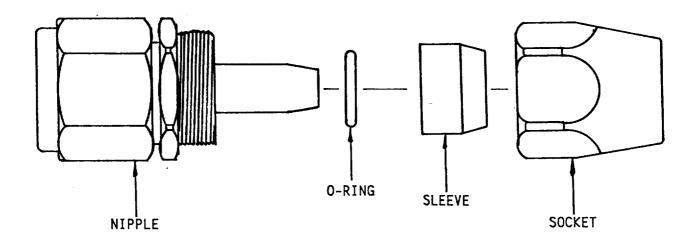


Figure 9-4. Four-Part Fitting

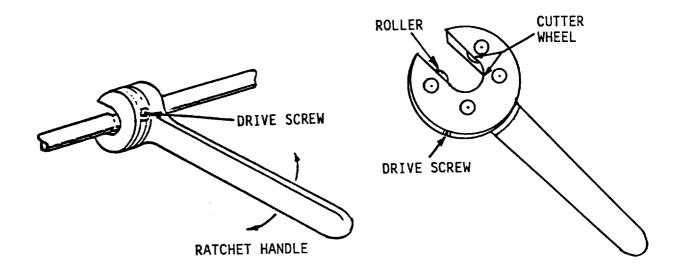


Figure 9-5. Using Tube Cutter

TM 55-1520-228-BD HYDRAULI C

Ratchet the cutter around the tubing applying a light pressure to the cutting wheel by intermittently twisting the setscrew. Too much pressure on the cutting wheel could deform the tubing or cause excessive burring. After cutting the tubing, carefully remove any burrs from inside and outside of the tube. If a tube cutter is not available or if tubing of hard material is to be cut. use a fine toothed hacksaw, preferably one having 32 teeth per inch. After sawing, file the end of the tube square and smooth and remove all burrs. Be sure all filings and cuttings are removed from the tubing. Inspect the tubing end to verify its roundness, its being cut square, and that it is clean and free from marks and scratches. Figure 9-6 illustrates properly burred tubi na.

NOTE

After tubing has been cut, all efforts should be made to flush any residue from the tube end. Flush with any available fluid or if end connections are inaccessible, momentary activation of the system will suffice.

9-7. ALUMINUM TUBING DAMAGE.

GENERAL INFORMATION: Aluminum tubing is subject to damage by projectiles and Replacement with original fragments. replacement parts is desirable, but not essential. In BDAR, tubing and hose, AN and MS fittings, and other similar components can be substituted one for the other. Available time, tools, skills, and materials will determine which Whenever an alurepair option to use. minum line has complex bends, replacement of the damaged section with hose, option 3, is probably the quickest fix.

OPTION 1: In Line Repair.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 30 Minutes

MATERI ALS/TOOLS REQUIRED:

- 2 MS Unions
- Splice Tube
- Tubing Cutter
- Knife or File
- 4 MS Fittings

- 1. Cut and remove damaged section of tubing, Figure 9-7. Tube ends must be square.
- 2. Clean ends of undamaged tubing with knife or file.
- 3. Measure the distance between the two undamaged ends and prepare a tube splice replacement section of this size. Clean ends of splice section as done in step 2.
- 4. Install an MS fitting on each end of the splice tube, Figure 9-8.
- 5. Insert the splice tube and tighten all fittings, Figure 9-9.
- 6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

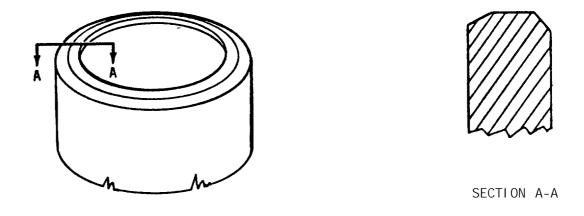


Figure 9-6. Properly Burred Tubing

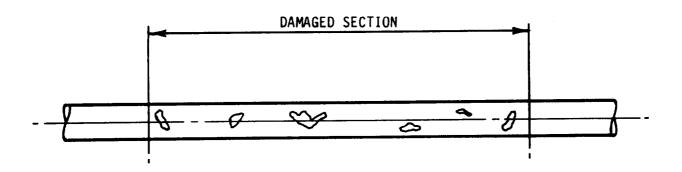


Figure 9-7. Damaged Tube Section

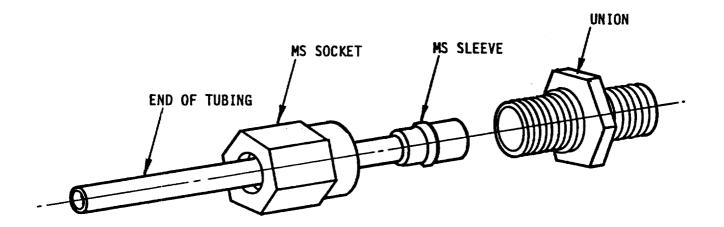


Figure 9-8. Splice Repair Assembly

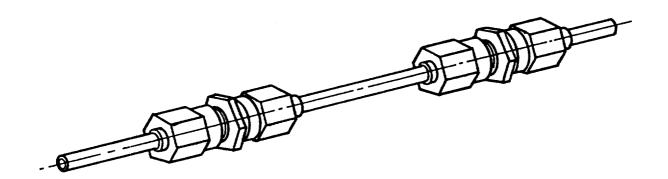


Figure 9-9. Repair Fitting and Tube Installation

OPTION 2: Substitute with High Pressure Hose (damage to section of tubing with bends).

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 30 Minutes

MATERIALS/TOOLS REQUIRED:

- Hydraulic Hose Assembly Complete with End Fittings
- 2 MS Unions
- 2 MS Fittings
- Tube Cutter
- Knife or File

PROCEDURAL STEPS:

- 1. Cut and remove damaged section of tubing, Figure 9-10. Tube ends must be square.
- 2. Clean ends of undamaged tubing with knife or file.
- 3. Install MS fittings as shown in Figure 9-8.
- 4. Connect MS unions to both MS fittings and complete the repair by connecting a hydraulic hose assembly from one union to the other, Figure 9-11. If the damaged length of tubing is long and more than one hose assembly is required, hose assemblies may be spliced together with unions. No harm will be done if the replacement hose is too long.
- 5. Clamp at convenient intervals (not exceeding 2 feet) to rigid supports to secure the line.
- 6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

9-8. HYDRAULIC HOSE DAMAGE.

GENERAL INFORMATION: The hydraulic hoses on the OH-58 are braided wire covered rubber hose. Repair of damage or wear to the wire braids is deferrable for one more flight, provided the rubber inner hose is not leaking under pressure. Inspect after every flight. If the inner rubber hose is leaking and a replacement assembly is not available, manufacture a new hose assembly. If an elbow fitting is not available, make a new hose with a large gentle loop so the hose will not kink. MS detachable fittings from a damaged hose may be reused in the manufacture of a new assembly as long as the threads and the seat are not damaged. Swaged fittings cannot be reused.

OPTION 1: Install New Hose Assembly-BDAR Kit.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:

- 1 Sol di er
- 20 Minutes

MATERIALS/TOOLS REQUIRED:

Hydrualic Hose Assembly

- 1. Remove damaged hose assembly.
- 2. Install new hose assembly (BDAR kit). It may be necessary to splice two or more hose assemblies together using MS unions to replace the damaged hose assembly. No harm will be done if the replacement hose is too long.

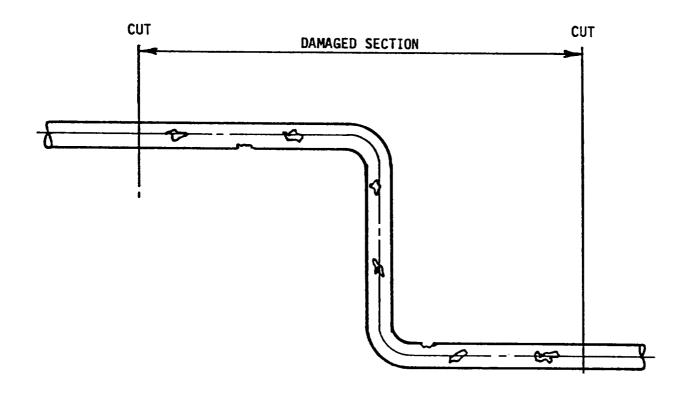


Figure 9-10. Damaged Tube Section-Complex Bends

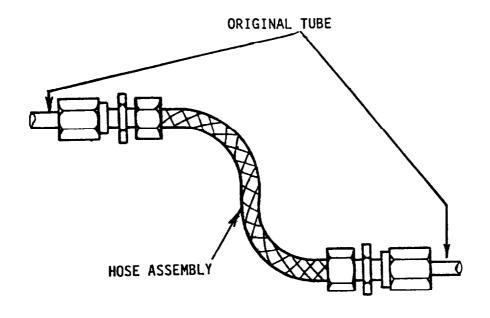


Figure 9-11. Splice Adapter Assembly Installation

3. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Replace Hose Section with MS Fittings (no BDAR hose assemblies available). For Teflon and rubber hose.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:

- 1 Sol di er
- 30 Mi nutes

MATERIALS/TOOLS REQUIRED:

- Replacement Section of Hose or Tube (if needed)
- Masking Tape (item 52, Appx C)
- Fine Toothed Hacksaw
- MS Fittings (socket, sleeve, and female fitting, 4 ea.)
- MS Uni on (2 ea.)

PROCEDURAL STEPS:

1. Cut out damaged hose section. Wrap masking tape (or other available tape) around hose over the areas where cuts are to be made to contain the braided wires from unraveling. Mark on tape where the cuts are to be made. Hold in a vice and cut with a fine-toothed hacksaw. Take care to make square cut. Do not remove tape.

NOTE

If the damage is small, the length of a single union may be sufficient to provide a repair. However, if the damage is longer, a replacement section will be required.

- 2. Obtain the proper sized MS fitting and unions.
- 3. Slip the MS socket over one of the undamaged ends of the hose, Figure 9-12. Use care not to unravel the wire braids.

- 4. Insert the MS sleeve between the wire braid cover and the inner rubber hose. Force onto hose until the edge of the sleeve is even with the end of the rubber hose.
- 5. Reem inside end of Teflon hose with a square tool or a wooden plug so that edge is smooth and flared to facilitate insertion of the nipple of the MS female fitting.
- 6. Slide the MS socket over end of hose as far as it will go and hold in vise. Insert nipple of MS female fitting into rubber inner tube, Figure 9-13. Force all the way until threads in socket and female fitting together and tighten until the gap between the edge of the socket and the base of the female fitting is approximately 0-1/32 inch for rubber and 0.025 to 0.045 inch for Teflon.
- 7. Prepare the other damaged end of the hose in the same manner.
- 8. If no replacement section is necessary, connect the MS fittings on the undamaged ends with an MS union, Figure 9-14.
- 9. If a replacement section is needed, obtain replacement section and cut to desired length. Refer to step 1 for procedure for cutting hose. No harm will be done if replacement section is too long. Attach MS fittings to both sides of the replacement section.
- 10. Place replacement section between the undamaged ends and connect the MS fittings on the undamaged ends to the fittings on the replacement section using MS unions.
- 11. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

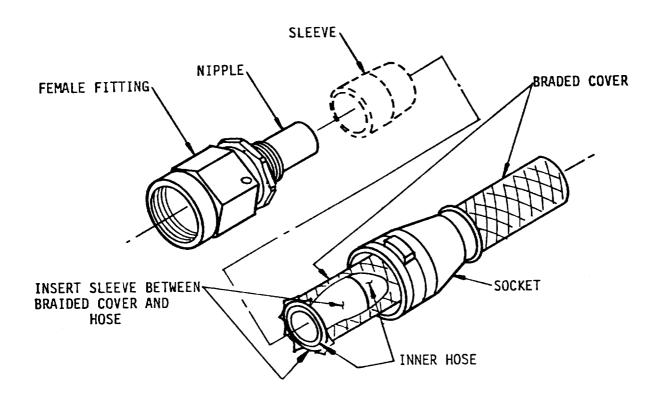


Figure 9-12. Installation of Socket and Sleeve

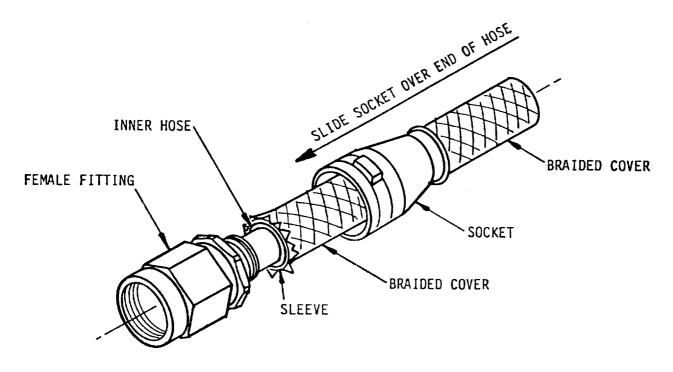


Figure 9-13. Assembly of MS Fitting

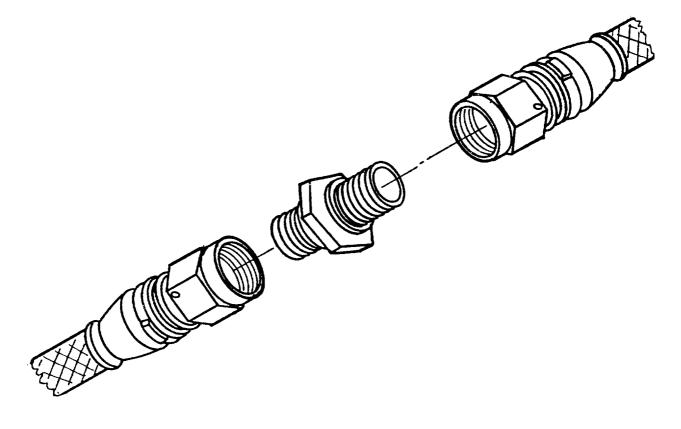


Figure 9-14. Union Connection

Section III. SEALS, PACKINGS, AND GASKETS

9-9. O-RING, PACKING, AND GASKET APPLICATIONS.

- a. O-rings are used in static and dynamic applications.
- (1) In static applications, the oring serves as a gasket when it is compressed within a recess. Leakage is not normally acceptable.
- (2) In dynamic applications, the sealing action is dependent primarily on the resilience of the o-rings. When moving parts are involved, minor seepage may be normal and acceptable. A moist surface found on moving parts of a hydraulic unit (piston shaft) is an indication that the seal is being properly lubricated.

- (3) Seal replacement is required when:
- (a) The amount of fluid being lost will cause system failure.
 - (b) The Leak creates a hazard.
- (c) The leak will not permit the system to function safely for one more flight.

NOTE

Packings and gaskets are identified by part number on packages. Do not remove from package until ready for use.

TM 55-1520-228-BD HYDRAULI C

- b. Selection of Proper Packing or Gasket. Selection of proper packing or gasket for a particular application is of the utmost importance. The exact size, shape, and material composition must be properly determined in order for various systems to function correctly. Packings, gaskets, or seals like fittings are made to an AN, MS, or NAS standard. While gaskets may look alike in general construction features and may be of the same size, they are not necessarily interchangeable (Table 9-2).
- c. The dimensional relationship between AN6227, AN6230, and MS28775 series o-ring packings and gaskets in the various sizes are as follows:
 - AN6227-B1 through B7 are equivalent to MS28775-006 through -012.
 - AN6227-B8 through B14 are equivalent to MS28775-110 through -116.
 - AN6227-B15 through B27 are equivalent to MS28775-210 through -222.
 - AN6227-B28 through B52 are equivalent to MS28775-325 through -349.
 - AN6227-B53 through B87 are equivalent to MS28775-426 through -460.
 - AN6227B88 is equivalent to MS28775-425
 - AN6230-B1 through B25 are equivalent to MS28775-223 through -247.

9-10. HYDRAULIC FLUID SUBSTITUTIONS.

a. If the original specified fluid is lost and standard replacement is not available, a substitute fluid must be used. Check Appendix D for a compatible fluid. If a compatible fluid is not available, any available nonflammable lubricant can be used in a BDAR action as a last resort.

CAUTION

O-rings, wipers, gaskets, or other plastic or rubber parts of the hydraulic system may swell or shrink, and for that reason continued operability of the system cannot be guaranteed. Following such a substitution, instructions for bringing the system back to normal should include checking all moving parts of the hydraulic system and all hydraulic activated devices for proper operation and leaks. Where feasible, plastic and rubber parts should be inspected for swelling, deformation, and other damage.

b. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

Table 9-2. Seals Reference and Temperature Guides Chart

	MI LI TARY	PARKER	BASE	TEMP GUIDE	DURO-	
SERI ES	SPECIFICATION	COMPOUND	POLYMER	CONT SERV	METER	SERVI CE
						Air Force and Navy
						hydraulic fluid
AN6227B	MI L-P-5516		NI TRI LE			MI L-H-5606,
AN67230B	Class B	PS-01-30-5	(BUNA N)	-65°F to +180°F	70	MI L-H-83282
			NI TRI LE			2 11 00202
MS28775	MI L-P-25732	N304-7	(BUNA N)	-65°F to +250°F	70	
MS29512						Air Force & Navy
MS29513			NITRILE			aircraft fuel
2-, 3-	MI L-P-5315	N602-7	(BUNA N)	-65°F to +180°F	60	JP-4, JP-5
						Syntheti c
MS29561	MI L-R-7362		NITRILE			lubri cants
NAS617	Comp. A, Type 1	47-071	(BUNA N)	-65°F to +250°F	70	MI L-L-7808
AN6290						Hydrualic oil,
MS28778			NITRILE			MI L-H-5606
2-, 3-	MI L-P-5510	N507-9	(BUNA N)	-65°F to +180°F	90	MI L-H-83282
NAS1593	MI L-R-25897		Fluoro-1			High temperature,
NAS1595	CL 1	77-545	Elastomer	-20°F to +400°F	70	fluid resistant.
NAS1594	MI L-R-25897		Fl uoro-1			High temperature,
NAS1596	CL 2	V-377-9	Elastomer	-20°F to +400°F	90	fluid resistant.
	DESI GNATI ON	PARKER	BASE	TEMP GUIDE	DURO-	SERVICE AND
SERI ES	ASTMI D735-58T	COMPOUND	POLYMER	CONT SERV	METER	SPECI FI CATI ONS
						Freon 12, weather
						& salt water
2-, 3-	SC720BCE1 E3 F2	C147-7	NEOPRENE	-65°F to +300°F	70	resistant. AMS3209
						General purpose
	00710051 50 50	0504.7	NEODDENE	/F0F 0000E		i ndustri al
2-, 3-	SC712BE1 E3 F2	C526-7	NEOPRENE	-65°F to +300°F	70	Neoprene. AMS3209
						Skydrol, Cellulube,
						& other phosphate
						esters, steam,
			ETHYLENE			water, air, dilute
2-, 3-	R810 B F2	F515-8	PROPYLENE	-65°F to +300°F	80	acids & alkalis.
	l					

TM 55-1520-228-BD HYDRAULIC

Table 9-2. Seals Reference and Temperature Guides Chart (Cont)

	lable 9-2.			emperature Guides		
	DESI GNATI ON	PARKER	BASE	TEMP GUIDE	DURO-	SERVICE AND
SERI ES	ASTMI D735-58T	COMPOUND	POLYMER	CONT SERV	METER	SPECI FI CATI ONS
						Mineral oil & hy-
						draulic fluid, water,
	SB620 B E1		NI TRI LE			steam, coolants,
2-, 3-	E3 F1	N525-6	(BUNA N)	-40°F to +250°F	60	pneumatic service.
			,			Petroleum base
MS9021						fuel & low tempera-
MS9020			NI TRI LE			ture resistance.
2-, 3-	SB712BE1 F2	N506-7	(BUNA N)	-65°F to +225°F	65	AMS7271
			, ,			Commercial gasoline,
						mineral oils &
			NI TRI LE			hydraulic fluids,
2-, 3-	SB715BE1 E3 F2	N103-7	(BUNA N)	-65°F to +225°F	70	pneumatic service.
2, 5			` ,			Mineral oil &
						hydraulic fluids,
						alkalies, gasolines,
			NITRILE			diesel oils,
2-, 3-	SB715BE1 E3 F1	N109-7	(BUNA N)	-30°F to +250°F	70	pneumatics.
AN1239XX			, ,			Petroleum base
AN1240XX			NI TRI LE			fuel resistant.
2-, 3-	SB715B E1 E3 F2	N179-7	(BUNA N)	-40°F to +250°F	70	AMS7270
AN1238XX						Petroleum base
AN1239XX			NITRILE			lubricating oil
2-, 3-	SB720B E1 F2	N180-7	(BUNA N)	-20°F to +250°F	70	resistant. AMS7274
	<u>-</u>					Listed by Underwriter
						Laboratori es for
			NITRILE			fuels, oils, and
2-, 3-	SB715E1 E3 F1	N214-7	(BUNA N)	-40°F to +250°F	70	gasol i nes.
	22.102. 20 11		` ′			Mineral oils &
						hydraulic fluids,
						gasolines, pneu-
			NITRILE			matics, SAE 120R
2-, 3-	SB715BE1 E3 F1	N219-7	(BUNA N)	-40°F to +250°F	70	Class 1, UL Listed.
	05,10521 20 11	,,,,,	(==::::,)			
I	ı	I	1	•	•	'

Seal's Reference and Temperature Guides Chart (Cont) Table 9-2. TEMP GUIDE DESI GNATI ON PARKER BASE DURO-SERVICE AND **POLYMER** CONT SERV METER SPECIFICATIONS **SERIES** ASTMI D735-58T **COMPOUND** Water service. Low swell, extremely NI TRI LE stable. Oil SB710 B E1 $-40^{\circ}F$ to $+250^{\circ}F$ resi stance. E3 F1 N398-7 (BUNA N) 70 2-, 3-For rotary seals. Do not use with NI TRI LE $-20^{\circ}F$ to $+225^{\circ}F$ 80 stainless steel. (BUNA N) 2-, 3-SB820B E1 E3 F1 N256-8 Mineral oils & NI TRI LE hydraulic fluids, $-20^{\circ}F$ to $+250^{\circ}F$ gasoline, pneumatics. N532-8 (BUNA N) SB815BE1 E3 F1 2-, 3-Mineral oil & hy fluids, pneumátics. High extru-NI TRI LE N183-9 (BUNA N) $-30^{\circ}F$ to $+250^{\circ}F$ sion resistance. 2-, 3-SB915B E1 E3 Mineral oil & hydraulic fluids NI TRI LE 90 N552-9 (BUNA N) $-30^{\circ}F$ to $+250^{\circ}F$ 2-. 3-SB915B E1 E3 pneumatics. Air & gases. Static seal TA-605B E1 only. AMS3303 SI LI CONE $-80^{\circ}F$ to $+450^{\circ}F$ 60 S418-6 2-, 3-E3 F2 Air & gases. Static seal TA705B E1 S417-7 SI LI CONE $-80^{\circ}F$ to $+450^{\circ}F$ 70 onl y. 2-, 3-E3 LF2 Air & gases. Static seal MS9068 TA-705BE1 only. AMS3304 S604-7 SI LI CONE $-80^{\circ}F$ to $+450^{\circ}F$ 70 2-, 3-E3 F2 High temperature oils, aromatic solvents, chemical Fl uoro-1 service. AMS7278 -20°F to +400°F 2-, 3-77-545 Elastomer 70 None High temperature oils, aromatic solvents, chemical Fl uoro-1 -20°F to +400°F 90 V377-9 servi ce. AMS7278 Elastomer 2-. 3-None

CHAPTER 10

INSTRUMENTS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

There are no BDAR repairs offered for the instrument systems.

CHAPTER 11

ELECTRICAL AND AVIONICS SYSTEM

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)

IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section 1. INTRODUCTION

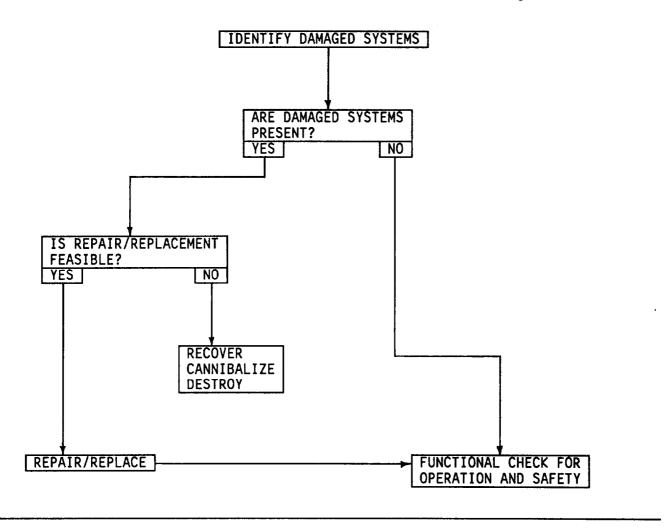
11-1. SCOPE. This chapter provides methods for assessing battle damage, deferring damage repair, and repairing electrical and avionics systems. Extensive repairs to complicated components or line replaceable units (LRUs) are not expected to be made in the field. Therefore, more emphasis is placed on common repairs to interconnecting cables and simple electrical and avionic components.

11-2. ASSESSMENT PROCEDURES. (See Table 11-1 for assessment logic.)

- a. Wire Identification. The most difficult and time consuming part of electrical and avionics battle damage assessment is wire identification. Added and repaired wiring should be identified to aid in troubleshooting. If time permits, tape or sleeving at each end of added wiring of a material suitable for the ambient temperature range may be used. Typical wire and circuit identification schemes are shown in Figure 11-1 and Table 11-2. Appendix F lists and depicts the major components, cable routes, and wiring terminations for the more complex avionics systems.
- b. <u>Circuit Function</u>. The unit number and circuit designation letter identify the type of circuits. The wire number consists of one or more digits.

- It is used to distinguish between wires in the same circuit. The wire segment letter is used to distinguish between conductor segments (a wire segment between two terminals or connections). The wire size number is used to identify the gage of the wire or cable. The ground, phase, or thermocouple letter(s) are used as suffixes to the wire identification code to further identify certain Ground wires are identified with an N suffix. Phase letters A, B, or C are added to identify the phase of wires that are in the three-phase wiring of alternating current (AC) systems. thermocouple wire, the following suffixes are added to the identification code: AL (Alumel), CR (Chromel), FE (Iron), CN (Constantan), and CU (Copper).
- c. <u>Deferral</u>. Repair of systems and subsystems, which have adequate redundancy or are not critical to mission accomplishment, may be deferred if safety of flight is not significantly degraded. Requirements must be examined to determine if relaxed criteria for repair and aircraft performance can be accepted. The commander may defer combat maintenance and battle damage repair, even if doing so places operational limitations on the aircraft.

Table 11-1. Electrical and Avionics Assessment Logic



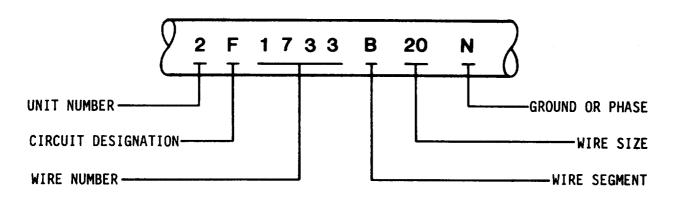


Figure 11-1. Circuit Identification

Table 11-2. Function and Designation Letters

CI RCUI 1	Table 11-2. Function and	CIRCUIT
DESI GNATI ON		DESI GNATI ON
LETTER	CI RCUI TS	LETTER CI RCUI TS
	011100110	LETTER CIRCUITS
A	ARMAMENT: Bomb suspension & release Guns Chemical Rocket Sight Turret Warning External pylons & stores Jettison fuel tanks Mine dispenser	F FLIGHT INSTRUMENT: Bank and turn Rate of climb Directional gyro Air position Ground position Compass (including flux gate and other stabilized compasses) Gyro horizon Attitude gyro Driftmeter
В	PHOTOGRAPHIC: Gun camera Mapping camera Reconnaissance camera Camera intervalometer Camera doors Camera heaters Warning	Altimeter Airspeed Accelerometer Pitot-static tube meter Warning H HEATING, VENTILATING, AND DE-ICING:
С	CONTROL SURFACE: Horizontal stabilizer Warning	Anti-icing (general) Battery heater Cabin heater Cigarette lighter
D	INSTRUMENT (other than flight or engine instruments): Ammeter Air pressure Free air temperature Hydraulic pressure Horizontal position stabilizer Voltmeter Clock	De-icing (general) Windshield defroster Windshield defogger Windshield de-icer Heater blanket Oil immersion heater Refrigeration Ventilation Warning
E	Warning ENGINE INSTRUMENT: Tailpipe temperature	In order to avoid confusion with the numeral one, the letter "I" shall not be used for circuit or cable identification.
	Fuel flow Fuel quantity Fuel capacity Oil temperature Oil pressure Manifold pressure Fuel pressure Engine oil quantity Tachometer Warning	J I GNI TI ON: Booster Vi brator Di stri butor El ectroni c Warni ng

	Table 11-2. Function and De	signation Letters (Cont)
CI RCUI	Т	CIRCUIT
DESIGN		DESI GNATI ON
LETTER	CI RCUI TS	LETTER CI RCUI TS
K	ENGINE CONTROL: Blower ratio Starter Warning	Q FUEL AND OIL: Fuel valves Fuel booster-pump motor Moisture control Oil dilution
L	LIGHTING: Approach Flasher-coder Cockpit Drift Cabin Formation Cargo Interior Instrument Section (fuselage) Landing Exterior Running, position, navigation	Engine primer Fuel-transfer-pump motor and control Fuel-loading-pump motor Oil transfer-pump motor and control Oil booster pump Oil scavenge pump Throttle control Fuel-pump motor Oil diverter Oil valves Warning
	Passi ng Search Taxi Warni ng	R RADIO (Navigation and communication): RA-Instrument landing RC-Command RD-Radio direction finding
М	MI SCELLANEOUS ELECTRIC: Wi ndshi eld spray Wi ndshi eld wi per Hoi st Enclosure operation Positioner; seat, pedal Special test equipment	RF-VHF liaison RH-Homing RL-Liaison RM-Marker beacon RN-Navigation RP-Special systems RS-SHF command RT-Radio teletype
Ν	UNASSI GNED	RU-UHF command RV-VHF command
0	In order to avoid confusion with the numeral zero, the letter "O" shall not be used for circuit or cable identi-fication.	RX-Recorder RZ-Interphone, headphone
Р	DC POWER	

	Table 11-2. Function and De		n Letters (Cont)
CI RCUI	T	CI RCUI	
DESI GN.	ATI ON	DESI GN	ATI ON
LETTER	CIRCUITS	LETTER	CI RCUI TS
S	RADAR: SA-Altimeter SF-Intercept SG-Gunlaying SM-Mapping SN-Navigation SQ-Bombing SR-Recorder SS-Search SV-Special systems	U	MISCELLANEOUS ELECTRONIC: Electronic wiring for which no "R", "S", or "T" designation has been assigned by the procuring activity shall have the circuit function letter "U" assigned. Examples of wiring for which the circuit function letter "U" will be assigned are common leads to electronic equipments and
Т	SW-Warning SX-Recognition (IFF) SPECIAL ELECTRONIC: TA-Adapter		systems interconnection wiring such as antenna or power circuits common to more than one equipment or system.
	TB-Radar control TC-Radio control TD-Airborne announcing TE-Electronic countermeasure TF-Repeat back	V	DC POWER and DC control cables for AC systems shall be identi- fied by the circuit function letter "V."
	TG-GM homing TH-Infrared TK-Telemetering TL-Attitude indicator TM-Chaff dispenser TN-Navigation TP-Beacon (crash and locator) TQ-Transmitters and receivers	W	WARNING AND EMERGENCY Enclosure release and locks Fire extinguishers Flare release Fire detector Intercrew buzzer or light
	TR-Receivers TT-Transmitters TU-Reconnaissance TW-Weather devices TZ-Bombing devices	X	AC POWER: Wiring in the AC power system shall be identified by the circuit function letter "X."
		Y	ARMAMENT SPECIAL SYSTEMS: Y*A-Air to air Y*B-Air to surface Y*C-Multimode Y*M-Missile-guidance Y*T-Turret * Armament special system number
		Z	UNASSI GNED

11-3. REPAIR PROCEDURE INDEX.

<u>PARA.</u>	PARA.
Splicing Unshielded Wires 11-5 Wire Repair Segments, Unshielded Wires 11-6	Coax Splice for RG-9 B/U, RG-214/U, RG-225/U, and RG-393/U 11-17
Damaged Wire Insulation 11-7 Shi elded Cable Repair 11-8	Coax Splice for RG-58 C/U, RG-233/U, RG-59 B/U, and
Shielded Cable Repair Segments 11-9 Shield Terminators 11-10	RG-71 B/U 11-18 Component Bridging 11-19
Terminators for Nickle-Plated Shields (including	Connector Repair 11-20 Circuit Protection Device
vermillion)	Repair
Terminal Lugs	Battery Repair BB-476/A 11-23
Coax Splice for RG-136/U	Damaged or Defective Power Relays
and RG-179 B/U 11-15 Coax Splice for RG-180 B/U,	Substitute Emergency Antenna, Field Expedient 11-25
RG-124/U, RG-142 B/U, RG-302/U, and RG-303/U 11-16	Typical Avionics Configuration 11-26 BDAR Kits

Section II. ELECTRICAL AND AVIONICS WIRING DAMAGE

- 11-4. GENERAL. The objective of electrical and avionics system battle damage repair is to restore damaged circuits which are mission essential. It is also used to make nonessential circuits safe. The repair procedures in this section are designated to quickly return an aircraft to a flyable condition.
- Electrical and Avionics Repairs. Electrical and avionics equipment receiving significant battle damage will The equipusually not be repairable. ment may require replacement to meet mission requirements. When replacement for nonessential system units are not available, the technician should, when possible, make the necessary repairs or adjustments on the unit for one more combat sortie. Avionics wiring, coaxial cables, and general aircraft wiring can be repaired using a variety of procedures and materials. Most of these techniques are considered standard for
- temporary repairs. Appendix F lists and depicts the major components, cable routes, and wiring terminations for the more complex avionics systems.

D 4 D 4

- b. Isolation of Nonessential Systems. To isolate damaged nonessential system wiring use crimp-on end caps, tape, or other insulating method. Secure wires to structure.
- c. BDAR Electrical Wiring System Repair Definitions and Capabilities. The BDAR wiring repair set provides for two types of aircraft electrical wiring repairs classified as "PERMANENT," or "TEMPORARY."
- (1) A permanent repair returns the electrical wiring system to full capability as manufactured with no degradation of any system operating characteristics. No periodic inspection or replacement is required with a permanent repair.

(2) A temporary repair returns the electrical wiring system to a reduced level of capacity with a possible slight reduction of system operational capability. Temporary repairs must be reinspected at 100 flight hours. At this time, a permanent repair will be performed or an extension of use for the temporary repair will be granted.

NOTF

Temporary repairs established in the TM will only be applied in time of war. The commander or his designated representatives may authorize deviations necessary to accomplish wartime requirements.

- d. Repair Techniques.
- (1) In battle, situations may arise that will require the assessor and repair personnel to develop innovative repair techniques. This section describes and illustrates some repair capabilities to broken and/or damaged wires, shielded or coaxial cables, electrical connectors, and associated electrical components in the combat environment.
- (2) Prior to performing any of the listed repairs, the repair technician must be knowledgeable in the application of the basic repair procedures and proficient in the use of wiring repair tools and materials.

11-5. SPLICING UNSHIELDED WIRES.

GENERAL INFORMATION: This procedure provides for repairing damaged unshielded wires.

WARNI NG

Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions.

CAUTI ON

Make sure aircraft power is off. Disconnect battery before touching any wires.

OPTION 1: Crimp Splicing.

LIMITATIONS: Only to be used for wire sizes 12-26. Where no more than one splice is made per 10 feet of wire, it is a permanent repair.

PERSONNEL/TIME REQUIRED:

- 1 Sol di er
- 10 Minutes

MATERIALS/TOOLS REQUIRED:

- Appropriate Size Splice (item 10, Appx B)
- Appropriate Size Sealing Sleeve (item 10, Appx B)
- Crimping Tool (item 10, Appx B)
- Strippers (item 10, Appx B)
- Heat Gun (item 10, Appx B)
- Reflector (item 10, Appx B)

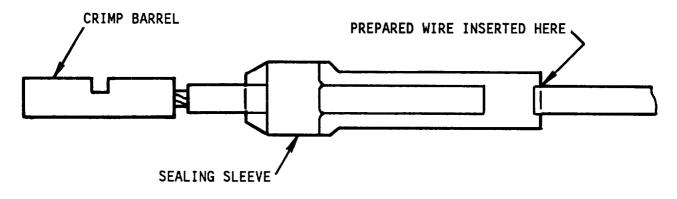
PROCEDURAL STEPS:

1. Strip wires, refer to Table 11-3.

Table 11-3. Unshielded Crimp
Splice Application

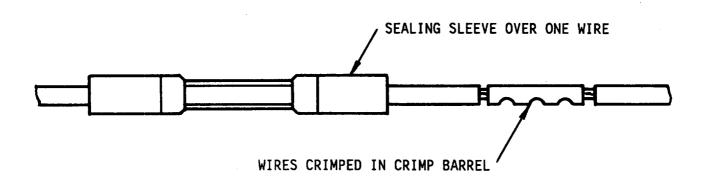
<u> </u>					
WI RE SI ZE	STRI PPI NG LENGTH , I NCHES	TEMP. RATING DEG. C			
20-26 16-18 12-14 20-26 16-18 12-14	. 25 30 . 30 35 . 30 35 . 25 30 . 30 35 . 30 35	>125 >125 >125 >125 <105 <105 <105			

- 2. Slide sealing sleeve onto one of the wires, Figure 11-2. On wire rated at 125°C or above, insert one prepared wire into small end of sealing sleeve and push crimp barrel out.
- 3. Crimp wires with crimp tool.



NOTE: → SLIDE SEALING SLEEVE OVER CRIMP

FOR WIRES 125°C OR ABOVE



FOR WIRES RATED 105°C OR BELOW

Figure 11-2. Crimp Splice

- 4. Shrink sealing sleeve over crimp with heat gun. Use reflector, temperature set at 900°F.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Terminal Lug Splicing.

LIMITATIONS: Only to be used on wire sizes AWG No. 10 and smaller. This is a temporary repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 15 Minues Per Splice

MATERIALS/TOOLS REQUIRED:

- Terminal Lug Barrel
- Insulating Sleeve and Tie Wraps or Heat-Shrinkable Insulation
- Crimp Tool

PROCEDURAL STEPS:

- 1. Select a terminal with a barrel large enough to accommodate both wires.
- 2. Cut off terminal lug tongue.
- 3. Prepare wire ends.
- 4. Slip an insulating sleeve 1 inch longer than terminal lug barrel over the end of one of the wires, and insert wire end into the barrel as shown in Figure 11-3.
- 5. Crimp barrel in center.
- 6. Slide insulating sleeve over the terminal lug barrel splice, and secure in place by using tie wraps or heating if heat-shrink sleeve is used.
- 7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 3: Split Bolt Splice Connectors.

LIMITATIONS: Only to be used on wire sizes AWG No. 4 through No. 10. Inspect after every flight.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 10 Minutes

MATERIALS/TOOLS REQUIRED:

- Strippers or Knife (item 10, Appx B)
- Heat—Shrinkable Tubing (item 10, Appx B)
- Split Bolt Splice Connector (item 10, Appx B)
- Heat-Shrinkable Tape (item 10, Appx B)
- Reflector (item 3, Appx B)

PROCEDURAL STEPS:

- 1. Slide a 3 inch length of large diameter, heat-shrinkable tubing over one of the wires to be spliced.
- 2. Strip wires and insert into the connector from opposite sides.

NOTE

Conductors may be folded back one or more times to fill the connector opening and provide firm clamping.

- Strip wires 1/2 inch if folding back is not required.
- Strip wires 1-1/4 inch if single folding back is required.
- Strip wires 2-1/2 inch if double folding back is required.
- 3. Tighten nut securely.
- 4. Wrap the splice with heat-shrinkable tape. Cover all metal parts and overlap onto insulation.
- 5. Heat the end of the tape to soften the adhesive layer and press it into position while warm. Use reflector (located in A5 of wiring kit), temperature set at 900°F.

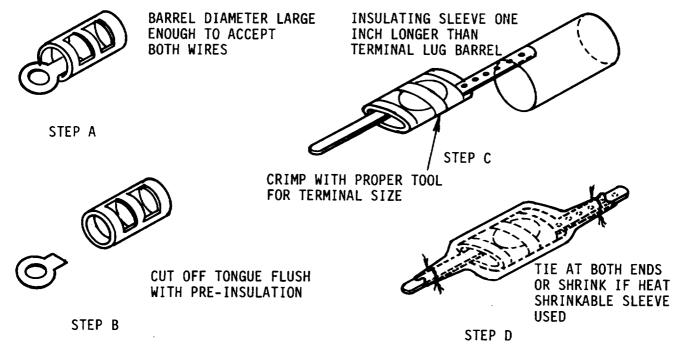


Figure 11-3. Splicing with Terminal Lug Barrel

- 6. Heat the tape to shrink it onto the splice and soften the adhesive layer. Use reflector (located in A29 of wiring kit), temperature set at 900°F.
- 7. Center the heat-shrinkable tubing over the splice.
- 8. Heat the tubing to shrink it onto the splice. Use reflector (A29), temperature set at 900°F. Begin in the middle and work toward the ends. Tubing may not shrink completely onto the wire insulation, this is normal.
- 9. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 4: Twist Wire.

LIMITATIONS: This is a temporary type repair.

PERSONNEL/TI ME

- 1 Soldier
- 10 Minutes

MATERIALS/TOOLS REQUIRED:

- Tape, Electrical (item 46, Appx C)
- Strippers or Knife

- 1. Cut ties and work broken wire to the outside of the bundle.
- 2. Pull sufficient slack from the wire run toward the break so that there will be no strain on the splice.
- 3. Wipe wire clean with a clean, dry rag or a rag dampened with 1-1-1 trichloroethane, alcohol, or equivalent.
- 4. Trim broken ends of the wire.
- 5. Split all the wire ends.
- 6. Split the strands of wire apart and twist the matching wires together as shown in Figure 11-4
- 7. Cover each individual splice with electrical tape. Insure no metal contact between adjacent splices.

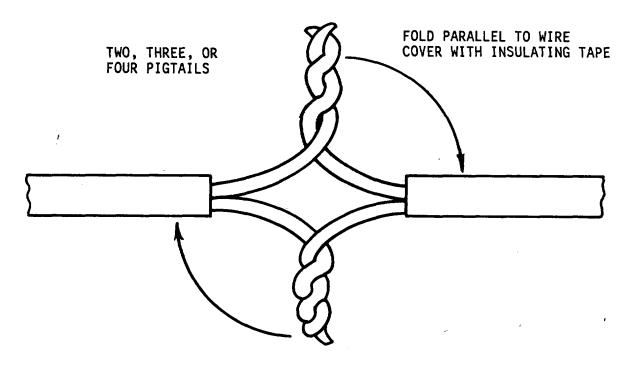


Figure 11-4. Twist Wire Repair

- 8. Cover splice area with electrical tape.
- 9. If a section of wire needs to be replaced, a double repair can be made, Figure 11-5.
- 10. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 5: Casing Splice Method.

LIMITATIONS: This is an emergency type repair for one time flight only.

PERSONNEL/TIME REQUIRED:

- 1 Sol di er
- 10 Minutes

MATERIALS/TOOLS REQUIRED:

- Cylindrical metal casing such as ball point pen refills, expended cartridges, etc.
- Insulation Sleeve or Tape (item 10, Appx B)
- Crimp Tool (hammer, pliers, etc.)
- Wire (item 10, Appx B)

PROCEDURAL STEPS:

1. Fabricate splices approximately 1 to 2 inches long from small metal casing.

NOTE

Ball point refills or expended cartridge shell casings, when cut to length, make excellent splices, Figure 11-6.

- 2. Strip 1/2 to 1 inch insulation from both ends of wire to be spliced.
- 3. Insert wires into casing splice and crimp tightly with pliers or a hammer and small iron bar.

TWO, THREE, OR FOUR PIGTAILS

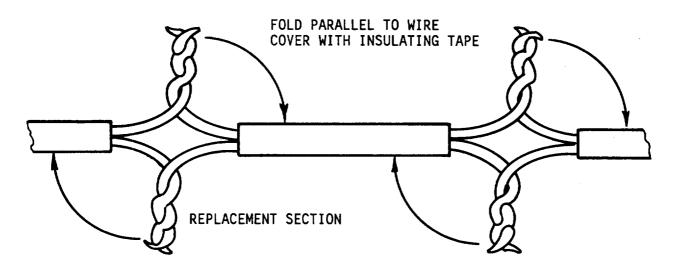
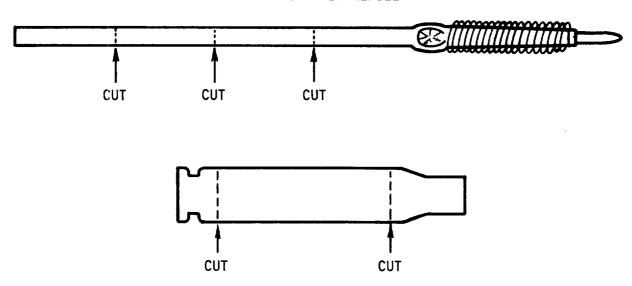


Figure 11-5. Replacement Section; Twist Wire Repair

BALL POINT PEN REFILL



EXPENDED CARTRIDGE SHELL CASING

Figure 11-6. Metal Casing Splice Repair

- 4. Insulate with tape or use plastic and string. Tie in place.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 6: Bolted Terminal Lug.

LIMITATIONS: This is a temporary type repair.

PERSONNEL/TIME REQUIRED:

- 1 Sol di er
- 10 Minutes

MATERIALS/TOOLS REQUIRED:

- Appropri ate Size Termi nal Lugs,
 2 ea. (i tems 54, 55, 56,
 57, 58, Appx C)
- Screw or Bolt
- Nut
- Washer
- Lockwasher
- Insulating Sleeve or Tape (item 52, Appx C)

PROCEDURAL STEPS:

- 1. Cut ties and work broken wire to the outside of the bundle.
- 2. Pull sufficient slack from the wire run toward the break so that there will be no strain on the splice.
- 3. Wipe wire clean with a clean, dry rag or a rag dampened with 1-1-1 tri-chloroethane, alcohol, or equivalent.
- 4. Trim broken ends of wire, and install an insulating sleeve over one end of the wire and slide back and out of the way for now.
- 5. Strip both wire ends and crimp an insulated terminal lug of the proper size to each wire end.
- 6. Bolt terminal lugs together as shown in Figure 11-7.

- 7. Slide the insulating sleeve over the splice so that the ends of the insulating sleeve extend at least 3/4 of an inch beyond the ends of each terminal lug. Secure both ends of the insulation with tie wraps or string ties as shown in Figure 11-7.
- 8. If a section of wire needs to be replaced, a double repair can be made to bridge the ends of the original wire back together, Figure 11-8.
- 9. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 7: Metal Clamp Method.

LIMITATIONS: This is an emergency type repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 10 Minutes

MATERIALS/TOOLS REQUIRED:

- Screw Clamp, Control Cable Clamp, or Safety Wire (item 26, Appx C)
- Insulating Sleeve or Electrical Tape (item 49, Appx C)
- Kni fe
- Cable Ties (item 10, Appx B)

- 1. Cut ties and work broken wire to the outside of the bundle.
- 2. Pull sufficient slack from the wire run toward the break so that there will be no strain on the splice.
- 3. Wipe wire clean with a clean, dry rag or a rag dampened with 1-1-1 trichloroethane, alcohol, or equivalent.
- 4. Trim broken ends of wire.
- 5. Remove 2 inches of wire insulation from each end of the damaged wire.

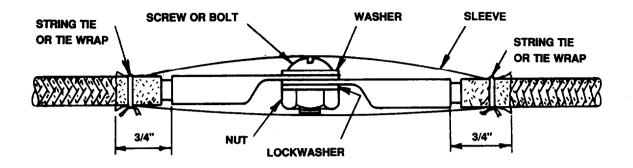


Figure 11-7. Bolted Terminal Lug Repair of Large Wires

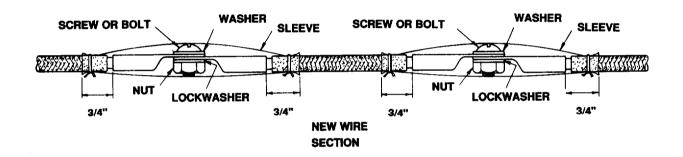


Figure 11-8. Replacement Section; Terminal Lug Repair

- 6. Ram or push the two wire ends together so that the strands interlink.
- 7. Secure with screw clamp, control cable clamp, safety wire, or other suitable means, Figure 11-9.
- 8. Insulate with tape or insulation sleeve.
- 9. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

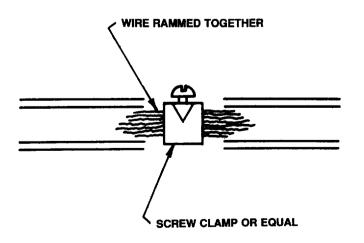


Figure 11-9. Ram Wire Repair Method

11-6. WIRE REPAIR SEGMENTS, UNSHIELDED WIRES.

GENERAL INFORMATION. The BDAR electrical wiring kit has wire replacement segments for replacement sections up to 9 inches in length. The replacement sections are located in the wire repair kit. Refer to Table 11-4.

CAUTION

Make sure aircraft power is off. Disconnect battery before touching any wires.

LIMITATIONS: Dependent on splice method used to connect replacement segment.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 20 Minutes

MATERIALS/TOOLS REQUIRED:

- Replacement Segment (Refer to Table Table 11-4)
- Splice (item 10, Appx B)
- Insulation Sleeve or Tape (item 49, Appx C)
- Crimp Tool (item 10, Appx B)

PROCEDURAL STEPS:

- 1. Cut out damaged wire (up to 9 inches in length).
- 2. Strip wires, refer to Table 11-4.
- 3. Splice replacement segment onto damaged wire using one of the options in paragraph 11-9.
- 4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-7. DAMAGED WIRE INSULATION.

GENERAL INFORMATION: If the wire insulation is damaged but the wire itself is not, repair of the insulation may be accomplished by installing heat-shrinkable tape, a transparent sleeve of flexible tubing, and securing with nylon braid or some other means.

CAUTION

Make sure aircraft power is off. Disconnect battery before touching wires.

OPTION 1: Heat-Shrinkable Repair Tape.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 10 Minutes

MATERI ALS/TOOLS REQUIRED:

- Heat-Shrinkable Tape (item 10, Appx B)
- Reflector (item 10, Appx B)
- Heat Gun/Heat Source (item 10, Appx B)

- 1. Start wrapping tape at one end of area to be covered.
- 2. Overlap each turn about one-third of tape width. Overlap of more than 50 percent or multiple wraps are not recommended. Excess thickness prevents heat transfer to the inner layer. Refer to Figure 11-10.
- 3. Apply heat to end of last lap to soften the meltable adhesive, and press it into position while warm. Use reflector (A5), temperature set at 900°F.

- 4. Heat the tape to shrink it and melt the adhesive layer. Use reflector (A29), temperature set at 900°F.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

Table 11-4. Wire Repair Segments

			9
	ITEM		WIRE
]	LOCATION	CRIMP	STRIP
WIRE	ELECTRICAL	COLOR	LENGTH
SIZE	WIRING KIT	GUIDE	(IN)
26,24,	B12-1	RED	.2530
22,20			
18,16	B12-2	BLUE	.3035
14,12	B12-3	YELLOW	.3035



WRAP ONLY TIGHT ENOUGH TO HOLD TAPE IN PLACE

TAPE WILL SHRINK TIGHTLY WHEN HEATED

Figure 11-10. Heat-Shrinkable Tape

OPTION 2: Insulation Sleeve.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 10 Minutes

MATERIALS/TOOLS REQUIRED:

- Insulation Sleeving (item 10, Appx B)
- Kni fe
- String, Nylon Braid, or Tie-Wraps. (item 10, Appx B)

PROCEDURAL STEPS:

- 1. Remove damaged insulation and examine to insure center conductor is not damaged.
- 2. Prepare a transparent sleeve of flexible tubing 1-1/2 times the outside diameter of the wire and 2 inches longer than the damaged portion of the insulation.
- 3. Split lengthwise and wrap 1-1/2 times around the wire at the damaged section.
- 4. Tie with string or other suitable material at each end and at 1 inch intervals over the entire length, Figure 11-11.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

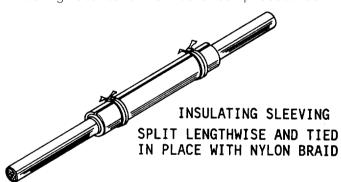


Figure 11-11. Insulation Repair with Sleeving

OPTION 3: Tape Insulation.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 5 Minutes Per Wire

MATERIALS/TOOLS REQUIRED:

- Tape, Electrical (item 49, Appx C)
- Kni fe

PROCEDURAL STEPS:

- 1. Remove damaged insulation and examine to insure center conductor is not damaged.
- 2. Wrap tape over exposed center conductor of wire. Tape should extend 2 inches over the wire insulation at each end of the area to be covered.
- 3. Record BDAR action taken. When mission is completed or as soon as feasible, repair using standard maintenance procedures.

OPTION 4: Potting Compound Insulation.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 1-3 Hours Per Wire (Depending on which potting compound is used.)

MATERIALS/TOOLS REQUIRED:

- Potting Compound Insulation (RTV-730, MIL-S-8516, synthetic rubber, or equivalent)
- Kni fe

PROCEDURAL STEPS:

- 1. Remove damaged insulation and examine to insure center conductor is not damaged.
- 2. Apply a thin coat of potting compound over the exposed center conductor.
- 3. Allow time to dry. If compound coating does not seem to be sufficient, apply additional layers as needed.
- 4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-8. SHI ELDED CABLE REPAIR.

GENERAL INFORMATION: The following procedures may be used to repair severed shielded cables.

OPTION 1: Shielded Cable Splice.

LIMITATIONS: Repair is good for cables rated at 125°C or above.

PERSONNEL/TIME REQUIRED:

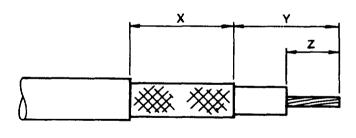
- 1 Soldier
- 15 Minutes

MATERIALS/TOOLS REOUIRED:

- Appropriate Size Splice (item 10, Appx B)
- Appropriate Size Sealing Sleeve (item 10, Appx B)
- Crimping Tool (item 10, Appx B)
- Strippers (item 10, Appx B)
- Heat Gun (item 10, Appx B)
- Reflector (item 10, Appx B)

PROCEDURAL STEPS:

1. Prepare cable for splice. Refer to Figure 11-12 and Table 11-5.



NOTE

Refer to Table 11-5. for X, Y, and Z

Figure 11-12. Shielded Cable Repair Preparation

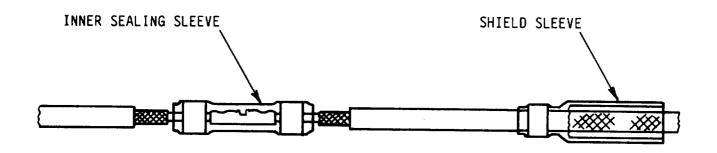


Figure 11-13. Shielded Cable Splice Preparation

	1-5. Shi €	el ded Cab	le Repair
WIRE	Х	Υ	Z
SIZE)	(IN.)	(IN.)	(IN.)
26,24			
22,20	.5055	.6575	.3035
18,16	.5055	.6575	.3035
14,12	.5055	.6575	.3035

- 2. Slide the shield sleeve onto one of the cables.
- 3. Slide the inner sealing sleeve onto the primary wires of one of the cables, then insert the other primary wire onto the other end of the inner sealing sleeve and crimp with AD-1377 crimp tool, located in electrical wiring kit. Refer to Figure 11-13.
- 4. Shrink the inner sleeve of the splice with temperature set at 900°F. Keep hot air away from shield sleeve.

5. Center and shrink the shield over the splice area so that the solder melts and flows. Shield sleeve braid must overlap cable braid at both ends. Refer to Figure 11-14

OPTION 2: Sheath Connector and Grounding Sheath.

LIMITATIONS: This is a temporary repair until heat shrink is installed, then it is a permanent repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 1/2 Hour Per Wire

MATERIALS/TOOLS REQUIRED:

- Insulating Sleeving, Heat Shrink, or Tape (item 49, Appx C)
- Kni fe
- String, Nylon Braid, or Tie Wrap (to be used if insulating sleeve is used)
- 2 Sheath Connectors (item 10, Appx B)
- Grounding Sheath (item 10, Appx B)
- Center Conductor Splice (item 10, Appx B)

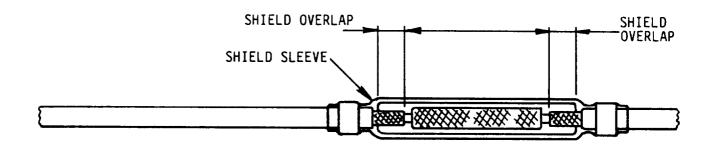


Figure 11-14. Shielded Cable Spliced

PROCEDURAL STEPS:

- 1. Select a grounding sheath
- 2. Prepare the severed ends of the cable for application of a grounding sheath connector, Figure 11-15, step a.
- 3. Position sheath connector and grounding sheath as shown in Figure 11-15, step b. (NOTE: Crimp sheath connector and grounding sheath only at one side at this time.)
- 4. Slide insulating sleeve over uncrimped sheath connector as shown in Figure 11-15, step b. (NOTE: If insulating sleeve is not available, use heat shrink or alternate insulation such as electrical tape.)
- 5. Splice center conductor using a permanent splice or by using one of the splicing procedures in paragraph 11-9.
- 6. Push the free end of the grounding wire into the uncrimped grounding sheath connector. Crimp securely, Figure 11-15, step c.

- 7. If an insulating sleeve is used, slide into place and tie both ends Figure 11-15, step d. If heat shrink is used, slide into place and shrink into position. If tape is used, use it to cover repair.
- 8. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 3: Pigtailed Sheath Method.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:

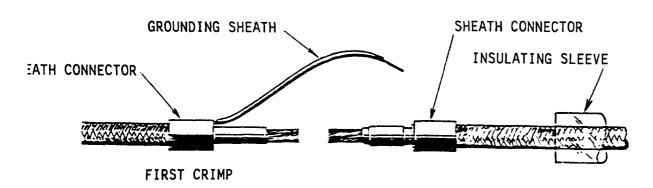
- 1 Soldier
- 1/2 Hour Per Wire

MATERI ALS/TOOLS REQUIRED:

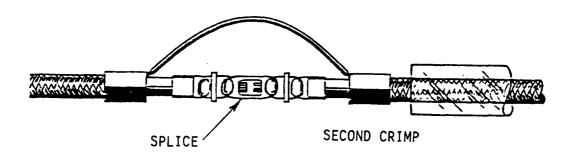
- Kni fe
- Insulating Sleeving or Tape (item 49, Appx C)
- String, Nylon Braid, or Tie Wrap (to be used if insulating sleeve is used)
- Center Conductor Splice (item 10, Appx B)



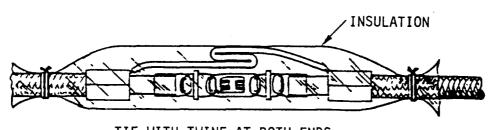
STEP A



STEP B



STEP C



TIE WITH TWINE AT BOTH ENDS

STEP D

Figure 11-15. Shielded Cable Repair

PROCEDURAL STEPS:

- 1. Prepare severed ends of cable for pigtail method of shield terminations, Figure 11-16, step a.
- 2. Splice center conductor, Figure 11-16, step b, using a permanent splice or by using one of the splicing procedures in paragraph 11-9.
- 3. Use two splice connectors to add short length of insulated wire as extension to complete shield connection, Figure 11-16, step b.
- 4. Insulate repair, Figure 11-16, step c.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 4: Substitute. Shielded Braid.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 1/2 Hour Per Wire

MATERI ALS/TOOLS REQUIRED:

- Substitute Shielded Braid (item 10, Appx B)
- Kni fe
- Center Conductor Splice (Item 10, Appx B)
- Metal Screw Clamp, Sheath Connector, or Equivalent

PROCEDURAL STEPS:

- 1. Prepare severed ends of cable for application of repair splice and shielding, Figure 11-17, step a.
- 2. Select suitable shielding material and slide over one end of severed cable.

Shielding must be long enough to overlap the shielding on both sides of the cable being repaired after the center conductor is repaired. Shielding material can be obtained from another shield cable or ground cable material.

NOTE

It is essential that the shielding, as well as the inner conductor, be repaired properly to prevent electromagnetic interference (EMI) problems.

- 3. Splice center conductor using a permanent splice or by using one of the splicing procedures in paragraph 11-9, Figure 11-17, step b. Insure center conductor is insulated from shield.
- 4. Slide shielding material over repaired inner conductor and clamp at shielding overlap areas, Figure 11-17, step c.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.
- 11-9. SHIELDED CABLE REPAIR SEGMENTS.

GENERAL INFORMATION: The electrical wiring kit has wire replacement segments to replace segments up to 9 inches in length.

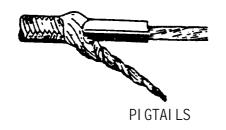
CAUTION

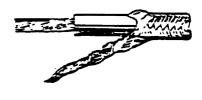
Make sure aircraft power is off. Disconnect battery before touching any wires.

LIMITATIONS: Dependent on splice method used to connect replacement segment.

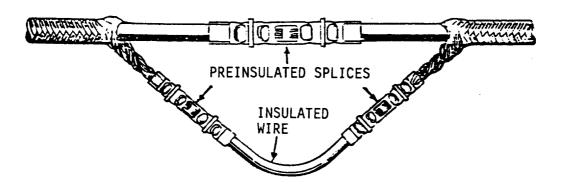
PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 1 Hour

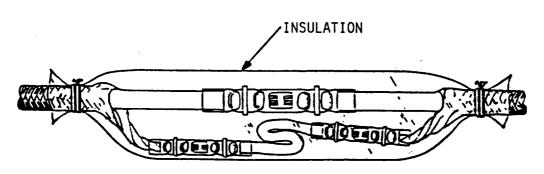




STEP A



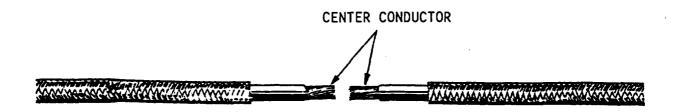
STEP B



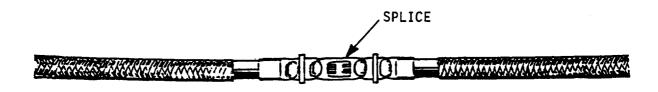
COVER WITH VINYL SLEEVE AND TIE AT BOTH ENDS

STEP C

Figure 11-16. Pigtail Method Repair



STEP A



STEP B

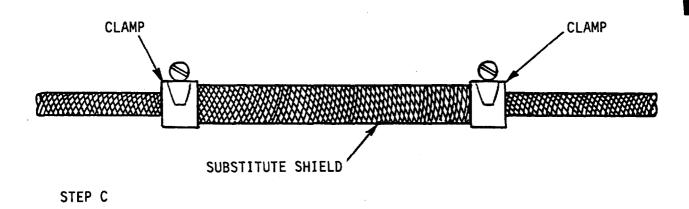


Figure 11-17. Substitute Shielded Braid Repair

MATERIALS/TOOLS REQUIRED:

- Replacement Segment (item 10, Appx B)
- Stripper or Knife
- Splice (item 10, Appx B)
- Insulation Sleeve (item 10, Appx B)
- Crimp Tool

PROCEDURAL STEPS:

- 1. Cut out damaged cable (up to 9 inches in length).
- 2. Prepare cable for splice. Refer to Figure 11-12 and Table 11-5.
- 3. Use one of the options of paragraph 11-5 to splice the ends of the replacement segment onto the damaged cable.
- 4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-10. SHI ELD TERMI NATORS.

GENERAL INFORMATION: The kit contains various types of shield terminators for shielded cable.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 15 Minutes

MATERI ALS/TOOLS REQUIRED:

- Shield Terminator (item 10, Appx B)
- Reflector
- Heat Gun/Heat Source
- Stripper or Knife
- Insulating Sleeve (item 10, Appx B)

PROCEDURAL STEPS:

1. Prepare cable for repair. Refer to Figure 11-18.

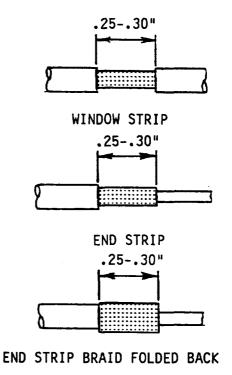
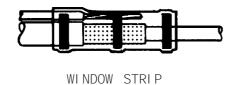


Figure 11-18. Shield Terminator Repair Preparation

- 2. Position shield terminator on cable as shown in Figure 11-19. (Select the smallest terminator that slides easily over the prepared cable.)
- 3. Heat shield terminator until solder melts and flows into wire strands, red color disappears, and seals melt and flow at both ends. Use reflector with shield terminator of wire repair kit with temperature set at 900°F.
- 4. Terminate the ground lead as directed in aircraft wiring manual.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.







END STRIP BRAID FOLDED BACK

Figure 11-19. Shield Terminator Repair

11-11. TERMINATORS FOR NICKEL-PLATED SHIELDS (INCLUDING VERMILLION).

GENERAL INFORMATION: The kit contains shield terminators for nickel-plated shields, including vermillion.

LIMITATIONS: This is a permanent repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 15 Minutes

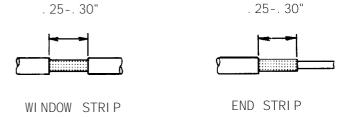
MATERIALS/TOOLS REQUIRED:

- Shield Terminator (item 10, Appx B)
- Reflector (A3) (item 10, Appx B)
- Heat Gun/Heat Source
- Stripper or Knife
- Insulating Sleeve (item 10, Appx B)

PROCEDURAL STEPS:

1. Prepare cable for repair. Refer to Figure 11-20.

- 2. Position ground lead and shield terminator as shown in Figure 11-21.
- 3. Heat shield terminator until solder ring melts; then, continue heating for an additional 15 seconds or until sleeve starts to turn brown. Use reflector with temperature set at 900°F.
- 4. Terminate the ground lead as directed in the aircraft wiring manual.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.



Fi gure 11-20. Ni ckel-Pl ated Shi eld Termi nator Preparati on

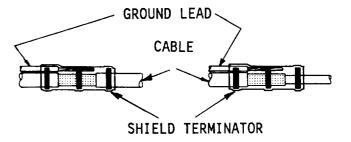


Figure 11-21. Nickel-Plated Shield Terminator Repair

11-12. TERMINAL BOARDS.

GENERAL INFORMATION: The terminal boards provided are all 5 inches in length. They are located in the wiring kit. They can be cut to shorter lengths using a hacksaw. The general procedure is as follows:

LIMITATIONS: Permanent repair.

PERSONNEL/TIME REQUIRED:

- 1 Sol di er
- Time will depend on the number of wires on the terminal board in question.

MATERIALS/TOOLS REQUIRED:

• Replacement Terminal Board (item 10, Appx B)

PROCEDURAL STEPS:

- 1. Tag and disconnect wires one at a time.
- 2. Remove terminal board.
- 3. Install replacement terminal board.
- 4. Connect wires to duplicate the original installation.
- 5. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-13. TERMINAL LUGS.

GENERAL INFORMATION: Terminal lugs are provided in the wiring kit, Table 11-6. The general procedure for installing terminal lugs is as follows:

LIMITATIONS: None

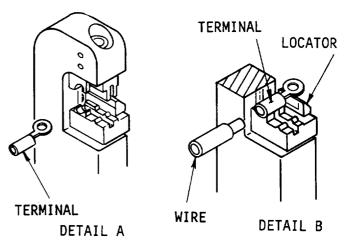
PERSONNEL/TIME REQUIRED:

- 1 Sol di er
- 110 Minutes Per Wire

MATERIALS/TOOLS REQUIRED:

- Strippers or Knife
- Replacement Terminal Lug (Table 11-6)
- Crimp Tool (item 10, Appx B)

- 1. Select a terminal to fit both the wire and the terminal stud, Table 11-6.
- 2. Strip the wire to the length specified in Table 11-6.
- 3. Open the dies of the crimp tool. Refer to Figure 11-22.
- 4. Place terminal in proper cavity of crimp tool dies (see Detail A of Figure 11-22). Sizes are stamped below each cavity on side of die.



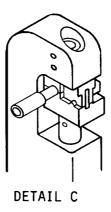


Figure 11-22. Terminal Lug Repair

				5 =
WI RE SI ZE	ITEM	STUD SIZE	P/N	WIRE STRIP LENGTH (IN)
24	B30	4 6 8 10	M7928/1-7 M7928/1-8 M7928/1-9 M7928/1-10	. 15
22	B31	8 10 _1/4 In.	M7928/1-14 M7928/1-15 M7928/1-16	. 19
20	B32	6 8 10 1/4 In.	M7928/1-21 M7928/1-23 M7928/1-24 M7928/1-25	
18	B33	6 8 10 1/4 In	M7928/1-30 M7928/1-32 M7928/1-33 M7928/1-34	
16	B34	6 8 10 1/4 In.	M7928/1-39 M7928/1-41 M7928/1-42 M7928/1-43	. 25
14	B35	6 8 10 1/4 In.	M7928/1-48 M7928/1-50 M7928/1-51 M7928/1-52	

- 5. Locate terminal with locator (detail B). Terminal should locate with flange over the top of the locator.
- 6. Insert wire to proper depth.
- 7. Close handle of tool until dies are closed and ratchet releases. The crimp is now complete (see detail C).
- 8. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-14. WIRE BUNDLE TIE WRAPS.

GENERAL INFORMATION: After wire damage repairs are made, insure minimum essential cable clamps, lugged bundle ties, and unlugged wire bundle ties are replaced.

OPTION 1: Self-Clinching Cable Straps.

LIMITATIONS: These straps are not to be used under the following conditions:

- •: In temperature environments which exceed 85°C (185°F).
- On coaxial cables or bundles containing coaxial cables which do not have hard dielectrics.
- In areas where excess material from strap cuttings or failure of the mounted strap would allow plastic to fall into moving mechanical parts.
- On the outside of cables or bundles that will be dragged through tight or unreachable spaces during final aircraft installation.
- Where failure of the strap would permit movement of the wiring against parts which could damage the insulation or allow wiring to foul mechanical linkages.
 - In high vibration areas.
- In areas of severe wind or moisture problems.

When use of these straps is prevented by these restrictions, use tie tape for secondary ties between clamps.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 1 Minute

MATERIALS/TOOLS REQUIRED:

- Self-Clinching Cable Strap (item 10, Appx B)
- Cable Strap Tool (item 10, Appx B)

PROCEDURAL STEPS:

1. Position the strap around the bundle with the flat side of the large end against the bundle.

- 2. Thread tip through eye then hand pull strap tight against the bundle. Refer to Figure 11-23.
- 3. Adjust the tool tension setting to 7.
- 4. Pass the free end of the cable tie through the slot in the end of the tool then push tool snugly against the strap, Figure 11-24.
- 5. While holding strap firmly against side of tool and tool faces squarely against large end of strap, pump handle several times without fully activating the tool's cutting knife. Once the strap has been stretched to its maximum, squeeze handle slowly and firmly until strap is cut.

WARNI NG

The strap must be cut flush with the surface in order to eliminate painful cuts and scratches from protruding strap ends.

- 6. If strap end is not cut flush, remove the strap and install a new strap in its place.
- 7. Pick up for appropriate disposal all broken straps and strap ends that were cut off.
- 8. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

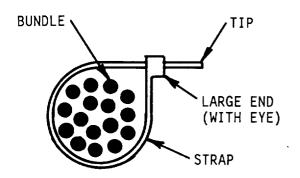


Figure 11-23. Self-Clinching Cable Strap

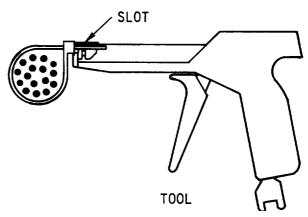


Figure 11-24. Self-Clinching Cable Strap and Tool

OPTION 2: Tie Tape.

LIMITATIONS:

- 1. Do not use ties on that part of a wire group or bundle located inside a conduit.
- 2. When tying wire bundles behind connectors, start ties far enough back from the connector to avoid splaying of contacts.

PERSONNEL/TIME REQUIRED:

- 1 Sol di er
- 1 Minute Per Tie

MATERI ALS/TOOLS REQUIRED:

• Tie Tape (item 10, Appx B)

- 1. Tie bundles tightly enough to prevent slipping, but not so tightly that the tape cuts into or deforms the insulation. Be especially careful when tying coaxial cable which has a soft dielectric insulation between the inner and outer conductors.
- 2. Use knot shown in Figure 11-25.
- 3. Tie all wire groups of bundles where supports are more than 12 inches apart. Space ties 12 inches or less.

WRAP CORD TWICE OVER BUNDLE

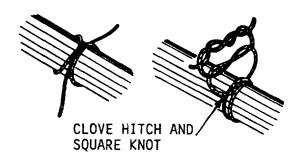


Figure 11-25. Tie Tape Repair Procedure

4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

NOTE

Harness branches can be secured by tying.

OPTION 3: String or Wire Repair.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 1 Minute

MATERIALS/TOOLS REQUIRED:

• Wire or String

PROCEDURAL STEPS:

1. Tie wires or groups using type knot shown in Figure 11-25.

CAUTION

Do not tighten wire or string too much, as wire or string can cut into or deform insulation.

- Space ties at 12 inches or less.
- Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-15. COAX SPLICE FOR RG-136/U AND RG-179B/U.

GENERAL INFORMATION: There are various coax splices in the wiring repair kit that may be used for the different types and sizes of coax cable.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 15 Minutes

MATERI ALS/TOOLS REQUIRED:

- Coax Splice (item 10, Appx B)
- Stripper or Knife
- Crimp Tool, AD-1377 (item 10, Appx B)Reflector (item 10, Appx B)
- Heat Gun/Heat Source (item 10, Appx B)

PROCEDURAL STEPS:

Prepare coax cable, Figure 11-26. Refer to Table 11-5.

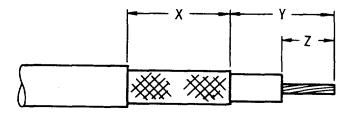


Figure 11-26. Coax Splice Preparation

- 2. Slide the shield sleeve and inner sleeve onto one of the coaxial cables in the order given.
- 3. Splice the center conductor. Use the red cavity of the crimp tool.
- 4. Shrink the inner sleeve over the splice, Figure 11-27. Use reflector, temperature set at 900°F. Keep the hot air away from shield sleeve.
- 5. Center and shrink the shield sleeve over the splice area so that the solder melts and flows, Figure 11-28. Shield sleeve braid must overlap coax braid at both ends. Use reflector, temperature set at 900°F.
- 6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.
- 11-16. COAX SPLICE FOR RG-180B/U, RG-124/U, RG-142B/U, RG-302/U, RG-303/U.

GENERAL INFORMATION: There are various coax splices in the wiring repair kit that may be used for the different types and sizes of coaxial cable.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 15 Minutes

MATERI ALS/TOOLS REQUIRED:

- Crimp Tool, AD-1377 (item 10, Appx B)
- Coax Splice (item 10, Appx B)
- Stripper or Knife
- Reflector (item 10, Appx B)
- Heat Gun/Heat Source (item 10, Appx B)

PROCEDURAL STEPS:

1. Prepare coax cable, Figure 11-26. Refer to Table 11-5.

- 2. Slide shield sleeve, inner sleeve, and filler sleeve onto one of the coaxial cables in the given order.
- 3. Splice the center conductor. Use the red cavity of the crimp tool.
- 4. Shrink the filler sleeve over the splice. Use reflector, temperature set at 900°F. Keep hot air away from inner and shield sleeves.
- 5. Shrink the inner sleeve over the splice, Figure 11-27. Use same reflector and temperature. Keep hot air away from shield sleeve.
- 6. Center and shrink the shield sleeve over the splice area so that the solder melts and flows, Figure 11-28. Shield sleeve braid must overlap coax braid at both ends. Use same reflector and temperature.
- 7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.
- 11-17. COAX SPLICE FOR RG-9B/U, RG-214/U, RG-225/U, RG-393/U.

GENERAL INFORMATION: There are various coax splices in the wiring repair kit that may be used for the different types and sizes of coax cable.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 15 Minutes

MATERIALS/TOOLS REQUIRED:

- Crimp Tool (item 10, Appx B)
- Coax Splice (item 10, Appx B)
- Stripper or Knife
- Reflector (item 10, Appx B)
- Heat Gun/Heat Source (item 10, Appx B)

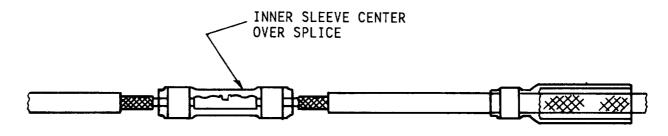


Figure 11-27. Coax Splice Inner Sleeve

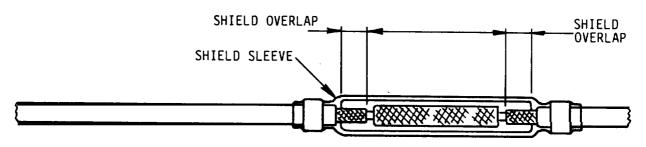


Figure 11-28. Coax Splice Shield Sleeve

PROCEDURAL STEPS:

- 1. Prepare coax cable, Figure 11-26. Refer to Table 11-5.
- 2. Slide the tubing, inner sleeve, and filler sleeve onto one of the coax cables in the order given.
- 3. Splice the center conductor. Use the red cavity of the crimp tool.
- 4. Shrink the filler sleeve over the splice. Use reflector, temperature set at 900°F. Keep hot air away from shield sleeve and tubing.
- 5. Center and shrink the shield sleeve over the splice area so that the solder melts and flows, Figure 11-29. Shield sleeve must overlap coax braid at both ends. Use same reflector and temperature. Keep hot air away from tubing.
- 6. Center and shrink the tubing over the splice area. Use reflector with temperature set at 900°F.

7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

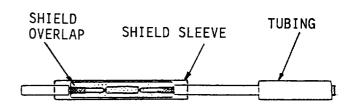


Figure 11-29. Coax Splice with Tubing Sleeve

11-18. COAX SPLICE FOR RG-58C/U, RG-233/U, RG-59B/U, AND RG-71B/U.

GENERAL INFORMATION: There are various coax splices in the wiring repair kit that may be used for the different types and sizes of coax cable.

LIMITATIONS: This is a temporary repair.

PERSONNEL/TIME REQUIRED:

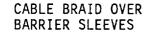
- 1 Soldier
- 15 Minutes

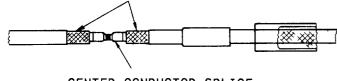
MATERIALS/TOOLS REQUIRED:

- Coax Splice (item 10, Appx B)
- Stripper or Knife
- Reflector (item 10, Appx B)
- Heat Gun (item 10, Appx B)

PROCEDURAL STEPS:

- 1. Prepare coax cable, Figure 11-26. Refer to Table 11-5.
- 2. Slide the shield sleeve and filler sleeve onto one of the coax cables in the order given.
- 3. Insert center conductors to overlap in center conductor splice. Barrier sleeves of center conductor splice fit under cable braids, Figure 11-30. Heat using reflector, temperature set at 900°F.
- 4. Shrink the filler sleeve over the splice. Use same reflector and temperature. Keep hot air away from shield sleeve.
- 5. Center and shrink the shield sleeve over the splice area so that the solder melts and flows. Shield sleeve braid must overlap coax braid at both ends. Refer to Figure 11-31. Use same reflector and temperature.
- 6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.





CENTER CONDUCTOR SPLICE

Figure 11-30. Coax Splice with Cable Braid over Barrier Sleeves

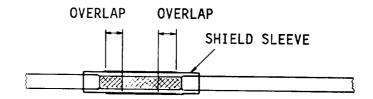


Figure 11-31. Coax Repair with Cable
Braid over Barrier Sleeve

11-19. COMPONENT BRIDGING.

GENERAL INFORMATION: In most cases, it will be quicker not to replace bulkhead connectors, junction boxes, or terminal strips. These circuits can be repaired by "bridging" the damaged area with jumper wires spliced in to eliminate the damaged area or component, Figure 11-32.

LIMITATIONS: Will be dependent on the type of splice used. Typically, temporary repair.

PERSONNEL/TIME REQUIRED:

• Will be dependent on the type of splice used. Typically 1 soldier, 15-30 minutes per splice.

MATERIALS/TOOLS REQUIRED:

• Will be dependent on the type of splice used.

- 1. Identify wires to be bridged together.
- 2. Splice wires and jumper wires together using one of the splicing techniques of this chapter.
- 3. Secure jumper wires after repair is made.
- 4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

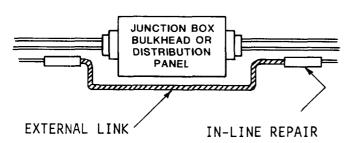


Figure 11-32. Component Bypass

11-20. CONNECTOR REPAIR.

GENERAL INFORMATION: Deformed, crushed, missing, or otherwise damaged connectors can be replaced or repaired. If a replacement connector is not available to replace a crushed connector, clean up fragments of the connector and use jumper wires to bridge wire ends together. If only part of the connector has been damaged and there are unused pins/sockets on the connector which are undamaged, wires on both sides of the connectors can be moved to the unused good pins/sockets. Also, any available undamaged pigtails on the connector may be used.

OPTION 1: Damaged Pins or Sockets; No Damage to Connector.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 10 Minutes Per Wire

MATERIALS/TOOLS REQUIRED:

- Replacement Pins/Sockets (item 2, Appx B)
- Insertion/Extraction Tool (item 2, Appx B)
- Kni fe

PROCEDURAL STEPS:

- 1. Solder or crimp wires to pin/sockets, Figure 11-33.
- 2. Insert the pins/sockets into the connector.

3. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

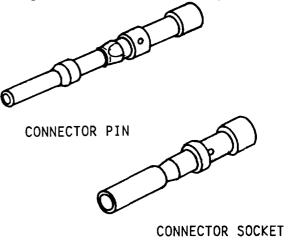


Figure 11-33. Connector Pin and Socket

NOTE

Superglue or epoxy may be used to secure the original or replacement pin back into place. Avoid getting glue or epoxy on contact surface of pin.

OPTION 2: Bridge Across Partially or Fully Damaged Connector.

LIMITATIONS: Temporary repair.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 10 Minutes Per Wire

MATERIALS/TOOLS REQUIRED:

- Wire Splice (item 10, Appx B)
- Wire (items 61, 62, Appx C)

- 1. Locate the damaged wire ends that go into connector.
- 2. Splice the appropriate wires together. The splice will bypass the connector.

3. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 3: Cannibalizing Connector from Other Aircraft.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 10 Minutes Per Wire

MATERI ALS/TOOLS REQUIRED:

- Replacement Connector with Pigtail
- Splices or Tape (item 10, Appx B)
- Kni fe

- 1. Obtain a replacement connector with a pigtail. (Replacement may be obtained from a crash damaged aircraft.) Cut pigtail so that splices can be staggered, Figure 11-34.
- 2. Remove damaged connector; stagger the wires being cut to remove the damaged connector. The staggered wires should match the staggered pigtail of the replacement connector of step 1, Figure 11-34.
- 3. Splice the appropriate wires together. Insulate properly.
- 4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

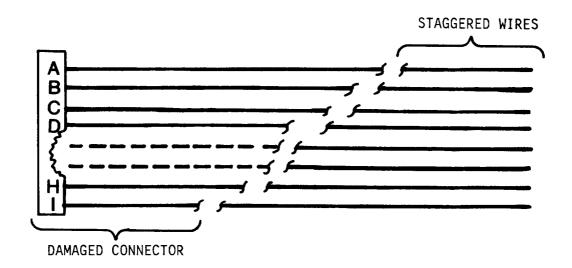


Figure 11-34. Damaged Connector and Pigtail

11-21. CIRCUIT PROTECTION DEVICE REPAIR.

GENERAL INFORMATION: Attempt to maintain a fused system at all times. Circuits with damage circuit breakers can be repaired by:

- a. Circuit breakers of the same rating salvaged from other non-flyable aircraft, or removed from other non-essential circuits in the aircraft.
- b. Replacing circuit breakers with a specified number of individual strands of No. 38 AWG wire from No. 26 AWG wire.

OPTION 1: Salvaged Circuit Breaker Replacement.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 20 Minutes

MATERIALS/TOOLS REQUIRED:

- . Salvaged Circuit Breaker
- . Electrical Tape (item 49, Appx C)

PROCEDURAL STEPS:

- 1. Gain access to area behind circuit breaker panel, Figure 11-35, by turning duze fasteners counterclockwise.
- 2. Remove screws holding plastic face plate on circuit breaker panel.
- 3. Use pliers to remove nut and inside star lock washer from damaged circuit breaker.
- 4. Use phillips screw driver to remove the two screws from the back of the circuit breaker.
- 5. Replace bad circuit breaker with the salvaged circuit breaker.

- 6. Connect back of circuit breaker to line and bus bar by reinstalling the two phillips screws.
- 7. Place inside star washer and nut on front of circuit breaker and tighten with pliers.
- 8. Replace plastic face plate on front of circuit breaker panel with screws previously removed.
- 9. Clean and remove any debris from inside circuit breaker panel and close panel. Secure by turning duze fasteners clockwise.

OPTION 2: Individual Strands of No. 38 AWG as Circuit Breaker BDAR Repair.

LIMITATIONS: Emergency repair.

PERSONNEL/TIME REQUIRED:

- . 1 Sol di er
- . 20 Minutes

MATERIALS/TOOLS REQUIRED:

. 1 Foot of No. 38 AWG Wire

- 1. Perform steps 1 thru 4 of option 1.
- 2. Identify the wires hooked to each circuit breaker. Typical circuit breaker is shown in Figure 11-36.
- 3. Determine amperage of damaged circuit breaker(s) to be replaced. (Amperage is printed on the end of reset button.)
- 4. Use Table 11-7 to determine number of strands of No. 38 AWG wire needed to replace damaged circuit breaker.
- 5. Select strands of No. 38 AWG wire to be used. Strands should be 6 to 8 inches long.

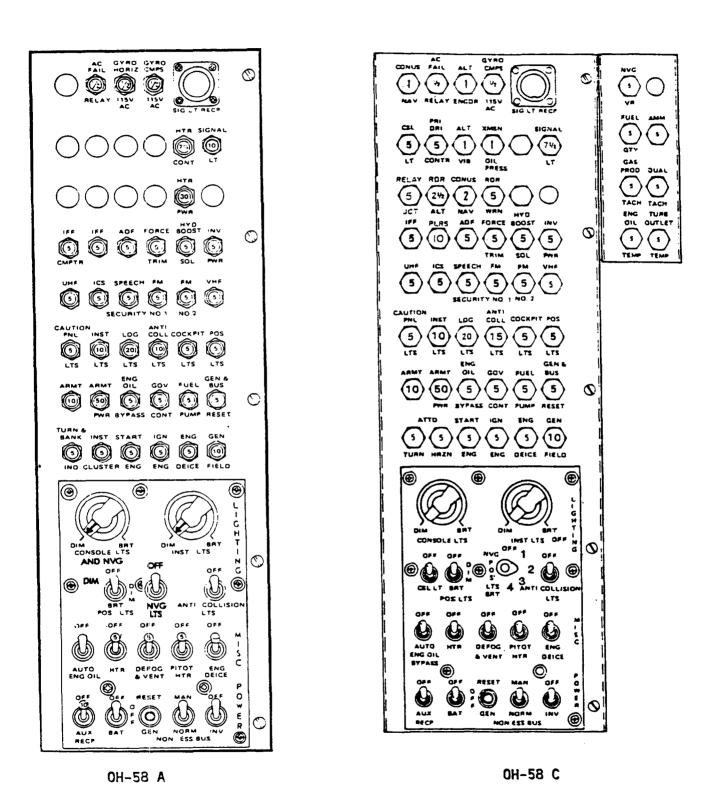


Figure 11-35. Circuit Breakers

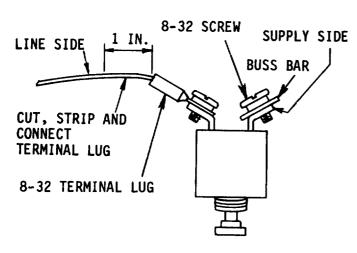


Figure 11-36. Typical Circuit Breaker Connection

Table 11-7. Fuse Link Strands

14010 11 71	. 400 211	iii oti aiide
CI RCUI T BREAKER AMPERAGE	AWG SIZE WIRE	NO. OF STRANDS
1/2A 1A 2A 3A 4A 5A 10A 15A 20A	NO. 38 NO. 38 NO. 38 NO. 38 NO. 38 NO. 38 NO. 38 NO. 38	1 1 1 2 2 2 5 7

NOTE

Try to use inner strands of wire that are not cut or nicked by knife used to remove insulation.

- 6. Remove line side, Figure 11-37, by unscrewing 8-32 screw. Repeat for supply side.
- 7. Twist the No. 38 AWG strands of wire from step 5 together and insert the end of line side of terminal lug; wrap and twist as shown in Figure 11-37. Slip 1 inch piece of insulation over

- No. 38 AWG strands of wire. Insert the other end of No. 38 AWG strands of wire into the other terminal lug (supply side). Pull tight against the piece of insulation and twist tight. Insulate bare end of terminal lugs on both sides of 1 inch piece of insulation with tape. Use 8-32 screw to connect other terminal lug to bus side of bus bar.
- 8. Use this procedure to replace damaged circuit breaker.
- 9. Secure fuse link to other wiring with tape to avoid pinching wire when circuit breaker panel is closed.
- 10. Clean up damaged area behind circuit breaker panel to remove debris, and use tape to insulate any damaged parts that might cause electrical shorts.
- 11. Carefully close circuit breaker panel and secure by turning duze fasteners clockwise.
- 12. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

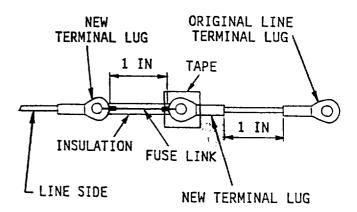


Figure 11-37. Construction of Fuse Link

11-22. BUS BARS.

GENERAL INFORMATION: Rigid bus bars are used in the power distribution circuits of the aircraft. Replace damaged bus bars with copper or brass strips of wire of the same or higher cross-sectional area. Use aluminum only when replacing aluminum bus bars since it makes unrealizable contact with other metals.

LIMITATIONS: Repaired bus bars will have a somewhat higher resistance than the original circuit and a higher than normal voltage drop may occur. Temporary repair.

PERSONNEL/TIME REQUIRED:

- . 2 Soldiers
- . 2 Hours

MATERIALS/TOOLS REQUIRED:

- . Drill and Bit
- . Nuts, Bolts, Flat Washers, Lock Washers
- . Tape (item 49, Appx C)
- . Brush, Wire
- . File
- . Hacksaw

PROCEDURAL STEPS:

- 1. Cut a section of another bus bar to use for splice.
- 2. Drill matching holes in bus bar sections and splice, Figure 11-38.
- 3. Remove insulation from bus bar only where needed. Insure contact surfaces of cracked bus bar and splice are smooth, and clean to reduce resistance. If necessary, use tile and wire brush to dress and prepare contact surfaces.
- 4. Install bolts and washers and tighten. Insure no contact of bolts with aircraft structure.
- 5. Insulate repair with tape or slit a piece of insulating tubing, and wrap around the repair and tie with string.

- 6. Same repair procedure can be used to lengthen bus bars, Figure 11-39.
- 7. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-23. BATTERY REPAIR, BB-476/A.

GENERAL INFORMATION: Nickel-Cadmium (Ni-Cad) batteries consist of a number of cells connected in series. Damage to a cell which does not result in short circuiting and destroying the battery. The following procedure gives instructions for locating and removing bad Ni-Cad battery cells and creating a jumper around the bad cell.

WARNI NG

- Ni-Cad batteries use potassium hydroxide, a strong caustic alkali, as the electrolyte. Do not get this electrolyte on your skin or in your eyes. Use rubber gloves, rubber apron, and protective goggles when handling the electrolyte. If accidental contact with the electrolyte is made, use ONLY clean water and immediately (seconds count) flush contaminated areas. Continue flushing with large quantities of clean water and get medical attention as soon as possible.
- . If steam or spewing electrolyte is observed or the battery is hot to the touch, DO NOT ATTEMPT TO remove from the aircraft immediately.

<u>CAUTION</u>

Penetration of battery case by small arms fire or shrapnel will cause thermal runaway. The battery cells will overheat and rupture, melt, or explode. Exercise extreme caution when repairing the battery.

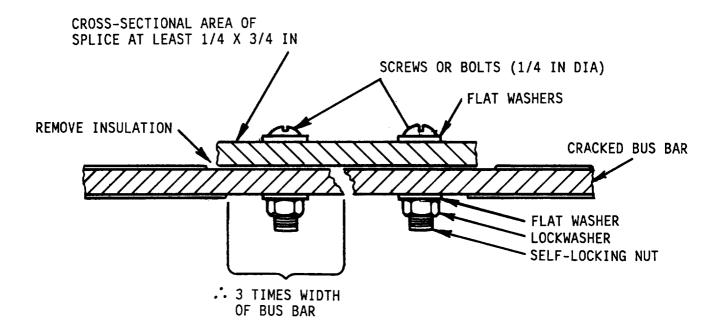


Figure 11-38. Splicing Bus Bars

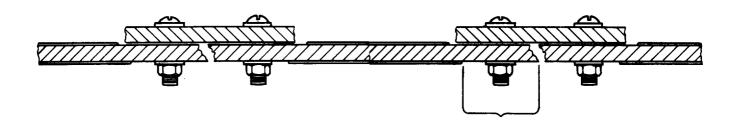


Figure 11-39. Lengthening Bus Bars

LIMITATIONS: Some loss of battery voltage (1.25 to 1.50 V dc per cell removed) and amperage capacity.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 30 Minutes

MATERIALS/TOOLS REQUIRED:

- . 1 Multimeter with Leads (item 9, Appx B)
- . Rubber Gloves
- . Protective Goggles
- . Rubber Apron
- . Torque Wrench
- . One Foot No. 4 AWG Wire or Equivalent

PROCEDURAL STEPS:

- 1. Disconnect battery and remove from aircraft if necessary.
- 2. Release snap fasteners and remove cover.
- 3. Use a multimeter to measure voltage across each cell. Normal readings should be 1.25 to 1.5 V dc per cell. Remove cells that are dead. For engine cranking loads, cell voltages as low as 0.6 V dc are acceptable. Also, remove any damaged, cracked, or extremely hot cells leaking or spewing electrolyte.

WARNI NG

Be extremely careful when removing or installing battery cells. Bodily injury and equipment damage may result if any metal tools or parts accidentally cause a short circuit.

4. To remove bad cells, use a 3/8 inch socket or equivalent to loosen and remove terminal screws. Remove washers and terminal links. To remove individual cells, screw terminal screws back into each cell terminal, grasp these screws with pliers and lift the cell straight up.

- . After removing bad cells, prepare jumper from 1 foot of No. 4 AWG and two terminal lugs. Remove 1/2 inch of insulation from one end of wire and crimp terminal lug on stripped end of wire. Measure and cut wire to needed length, strip 1/2 inch of insulation, and crimp terminal lug to other end of wire.
- 6. Install jumper across removed cells in place of terminal links. Cells are connected in series (positive to negative), Figure 11-40.
- 7. Torque terminal screws to between 35 and 50 inch-pounds. If torque wrench is not available, tighten firmly with wrench or pliers.
- 8. Replace cover and install battery in aircraft.

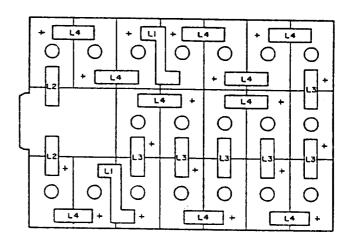


Figure 11-40. Battery, Storage BB-476/A, Cell Layout

11-24. DAMAGED OR DEFECTIVE POWER RELAYS.

GENERAL INFORMATION: A power relay is an electrically operated switch between the main bus and other electrical components in the aircraft. The relays are normally controlled by a switch in the cockpit. Damage incurred to power relays may be temporarily fixed by one of two options.

- a. First option: Replace with good relay salvaged from non-flyable aircraft or a nonessential circuit.
- b. Second option: Jumper across power terminal and bus bar terminal studs located on relay case. To check power relay for malfunction, locate terminals X1 and X2 on the relay. With a multimeter set on the 0-50 V dc scale, check the voltage from terminals X1 and X2 to the aircraft fuselage (ground), Figure 11-41. One of the two terminals should have 24-28 V dc on it when the power relay control circuit is energized. No dc voltage indicates

damage to the control circuit wiring. Repair control circuit wiring. With 24-28 V dc applied to terminals X1 or X2 of the power relay, check the voltage between terminals A1, A2, and the aircraft fuselage (ground), Figure 11-41. The voltage on terminals A1 and A2 should be identical. If there is no voltage on either one of the two terminals A1 or A2 with the relay energized, the relay should be considered defective and replaced.

OPTION 1: Salvaged Power Relay Replacement.

NOTE

Identical part number (Figures 11-42) denotes interchangeability. If damage is extensive, salvaged relays may be difficult to attach to bulkheads.

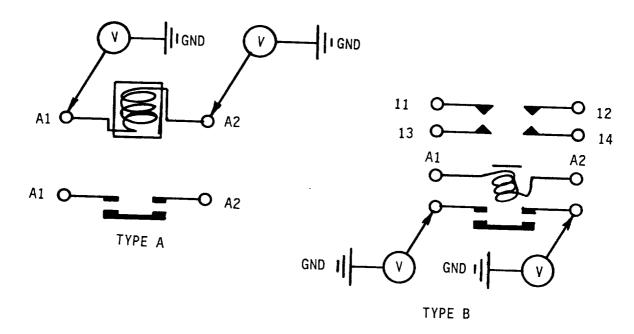


Figure 11-41. Block Diagram Power Relay, Check and Test

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:

- . 1 Sol di er
- . 30 Minutes

MATERI ALS/TOOLS REQUIRED:

. Salvaged Power Relay

PROCEDURAL STEPS:

- Obtain salvaged power relay.
- 2. Disconnect battery.
- Remove damaged power relay as follows:

NOTE

Note the position of wires/bus bar and what terminals they are connected to.

- a. Remove attaching hardware, wires, and bus bar.
- b. Remove attachment bolt, and lift relay free from compartment.
- Position salvaged power relay, and install mounting hardware.
- Install wires and bus bar on correct terminals, and secure with hardware.
- Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Creating a Jumper for Damaged Power Relays.

CAUTI ON

- . Do not jumper battery relay on an aircraft.
- . This procedure is to be used only for one time emergency evacuation and recovery of OH-58 A/C.

LIMITATIONS: Emergency repair. No control over jumpered power relays, circuit cannot be turned on or off.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- . 20 Minutes

- MATERIALS/TOOLS REQUIRED:
 . Appropriate Size Aircraft Type Wire
- . Appropriate Size Terminal Lugs

PROCEDURAL STEPS:

- 1. Disconnect battery.
- 2. Figure 11-43, Type A and B, shows two typical power relay configurations with jumper. This may be used as an aid in performing steps 3 thru 7.

NOTE

Use wire with the same gage or larger than the one being replaced.

- 3. Prepare a jumper wire, Figure 11-44. (A 1/2 to 1 foot length of appropriate size aircraft wire with appropriate size terminal lugs crimped on each end.)
- Locate terminals marked A1 and A2 on power relay. Power relay terminals should be marked on case of relay. If markings are illegible, A1 and A2 terminals will be the ones with the largest diameter terminal studs.
- Remove hardware from terminals A1 and A2.
- 6. Install jumper from terminal A1 to terminal A2. Reference Figure 11-45, Type A and B.
- Install hardware on terminals A1 and A2. Tighten hardware to hold jumper in pl ace.
- Remove jumper as soon as emergency evacuation flight is completed.

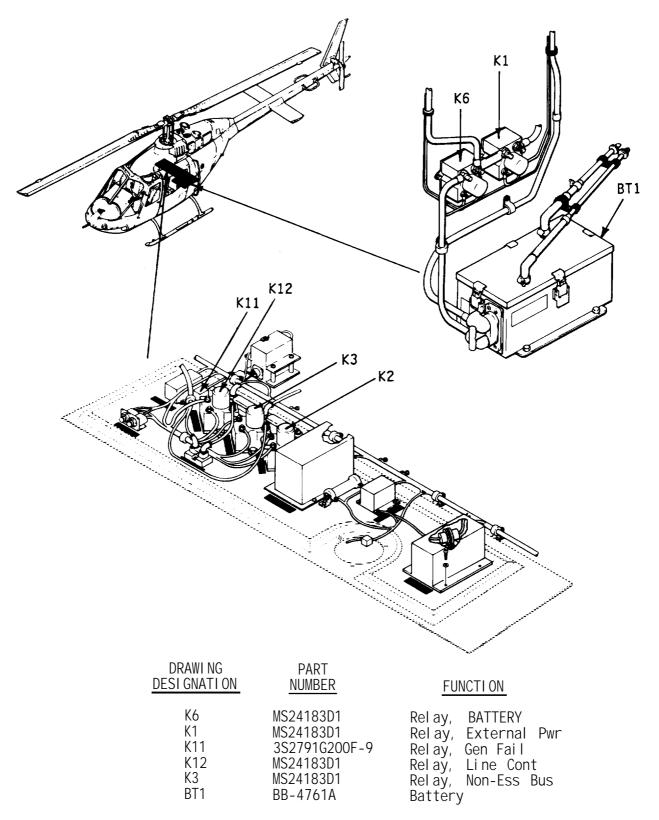


Figure 11-42. Location of Power Relays

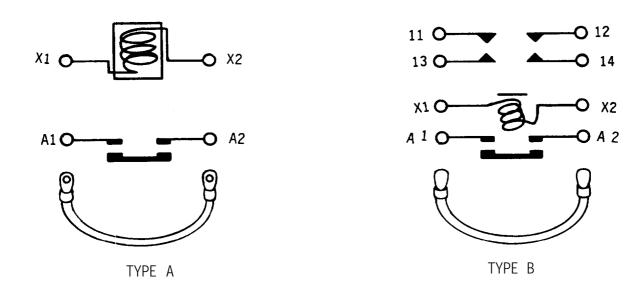


Figure 11-43. Block Diagram, Typical Power Relays



Figure 11-44. Jumper Wire Fabrication

9. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

11-25. SUBSTITUTE EMERGENCY ANTENNA, FIELD EXPEDIENT. This section contains expedient repair procedures to restore radio communication needed to complete the mission.

GENERAL INFORMATION: These procedures give instructions for use of substitute and/or construction of replacement antennas that can be used to transmit and receive radio messages.

WARNI NG

Do not touch bare wires on expedient antennas with the radio keyed. You could get burned and/or shocked.

OPTION 1: Use of Substitute Antennas.

LIMITATIONS: Some loss of antenna gain and radio transmitter power.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 30 Minutes

MATERIALS/TOOLS REQUIRED: None

PROCEDURAL STEPS:

- 1. Be sure that FM No. 1 (1 AN/ARC-114) circuit breaker and BAT switches on the overhead console are off.
- 2. Remove vent screen from left side of horizontal console to obtain access to No. 1 FM radio connectors.

CAUTION

Do not pull on cables when disconnecting cable connectors. Be careful to avoid any unnecessary strain on the cables.

NOTE

If No. 2 FM radio and securevoice control indicator are not installed, blank panels may be removed to obtain additional access to connectors.

- 3. Disconnect cable connectors from J1, J2, J3, and J4.
- 4. With a screwdriver, turn the six fasteners that secure the unit to the mounting panel one-quarter turn counterclockwise.
- 5. Slide the No. 1 FM radio out of the mounting panel.
- 6. Locate coax cable (2 ARC 114-101A) stored in console and use it to replace coax cable (1 ARC 114-101A). Connect it to J2.

NOTE

Both left and right-hand homing antennas may also be used as emergency transmitting antennas by using either coax cable (1 ARC 114-103A) or (1 ARC 114-103A) connected to J2.

- 7. To replace No. 1 FM radio, be sure that FM 1 circuit breaker and BAT switches on the overhead console are off.
- 8. Slide the No. 1 FM radio into the mounting panel and turn the six fasteners one-quarter turn clockwise to secure the unit.
- 9. Connect the coax cables to the rear of the No. 1 FM radio.
- 10. Attach vent screen to left side of horizontal console.

NOTE

The above procedures apply to the No. 1 FM radio and to the No. 2 FM radio when it is installed,, except that J3 and J4 are not used on the second radio.

OPTION 2: Construction of Replacement Antenna.

LIMITATIONS: Some loss of antenna gain and radio transmitter power.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 1 Hour

MATERIALS/TOOLS REQUIRED:

- . Cable, Coax RG-58U or Other Available Coax
- . Tape, Electrical (item 46, Appx C) or Equivalent
- . Resistor, Carbon, 1 Watt 52 Ω ±5 percent.

PROCEDURAL STEPS:

1. Determine length of wire needed for the radiating element by using Figure 11-45. Example:

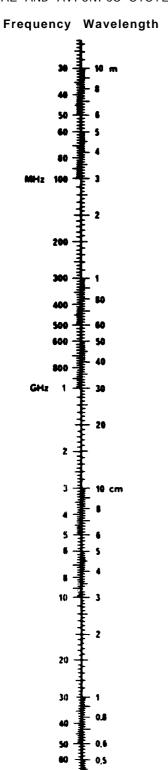


Figure 11-45. Frequency vs. Wave Length

TO CHANGE				M	UL ⁻	TIF	PLY BY
Centimeters		Inches.					0. 394
Meters		Feet					3. 280

- FM radio with frequency range of 30 to 69.95 MHZ.
- Center of frequency range is 50 MHZ.
- Using Figure 11-45, look under frequency column for 50 MHZ on the wave length side of the Table, 6 M is shown.
- Use Figure 11-45 to convert meters to feet. Six meters multiplied by 3.280 = 19.68 feet for one wave length.
- Divide the one wave length by 8, for a 1/8 wave length antenna, 19.68 = 2.46

feet. Multiply the 1/8 wave length by a .95 correction factor: 2.46 ft. X .95 = 2.34 feet. This is the length of the radiating element.

- 2. Cut the coax cable to the length of the required radiating element. Remove the outer insulation and shield from the piece of coax cable and then strip a 1 inch piece of insulation from each end exposing the center conductor, Figure 11-46A.
- 3. Wrap and solder the 52 Ω resistor to one end of the radiating element as per Figure 11-46B. This completes the fabrication of the radiating element of the antenna.
- 4. Next, remove the structural panel on the right-hand side just forward of the tail boom, Figure 11-47, by removing twenty-seven screws.
- 5. At the tail boom quick disconnect, locate coax cable marked 1 ARC 114-101B and disconnect it. Remove the coax connector and prepare a 4 inch pigtail termination on the end of the coax cable as shown in Figure 11-46C.
- 6. Stick the radiating element of the antenna from step three with the resistor end down into the drain hole in the bottom of the tail boom where it joins the fuselage, Figure 11-47.

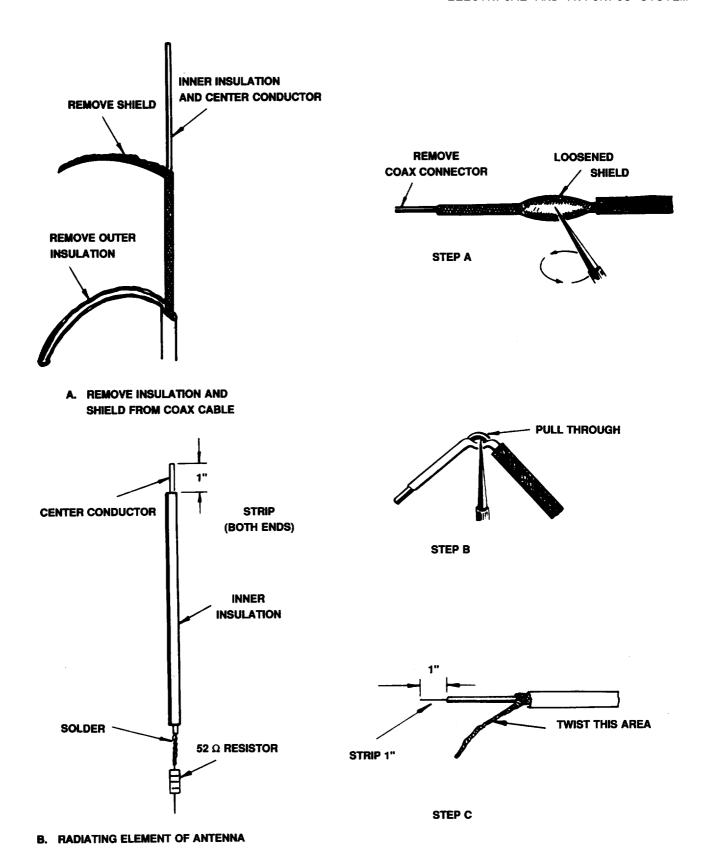


Figure 11-45. Preparation of Coax

- 7. Twist the center conductor from the radiating element of the antenna to the center conductor of the coax. Make a good mechanical joint and insulate with tape.
- 8. Ground the pigtail from the coax antenna by wrapping and twisting it around the plug where the coax was disconnected.
- 9. Secure with tape to hold the antenna and coax in place inside the

tail boom. Replace the structural panel and secure with screws.

NOTE

Antenna must be at right angle (90°) to aircraft skin to radiate R.F. energy. Do not tape antenna to skin of aircraft.

10. Using tape, tape a one to two ounce weight below the 52 Ω resistor as shown in Figure 11-47.

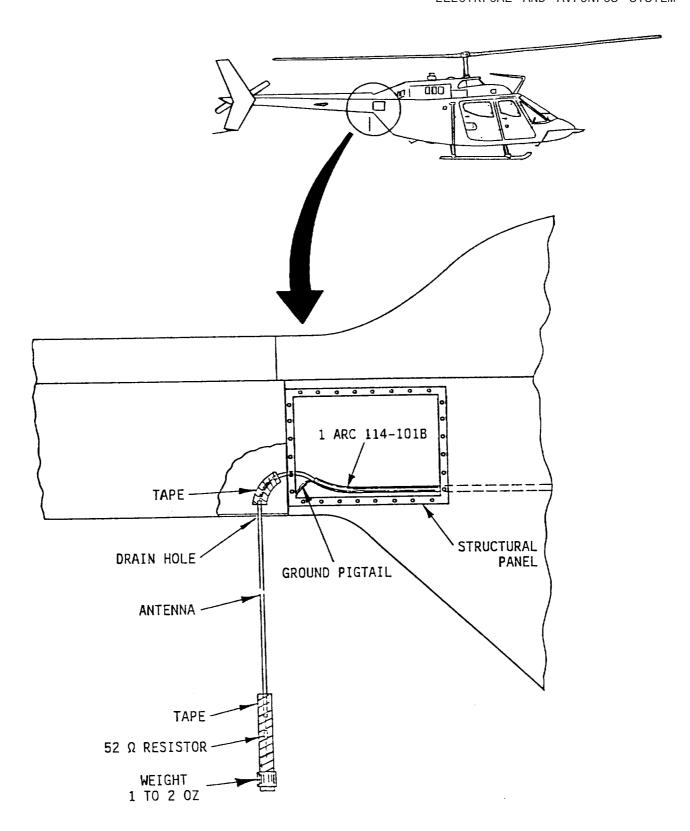


Figure 11-47. Installation of Field Expedient Antenna

FUEL SYSTEM

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

12-1. GENERAL.

- a. The fuel supply system, Figure 12-1, consists of a crashworthy bladder type, self-sealing cell. The fuel cell is designed to fit under the passenger seat, in the floor cavity of the fuse-lage. The system's fuel flow lines are self-sealing. The rigid lines are used for fuel flow or as vent lines. The fuel boost pump is the cartridge type which can be replaced without defueling.
- b. The fuel tank will self-seal when damaged by small arms projectiles up to 50 caliber. Damage to the tank and the

fuel system must be evaluated very carefully to determine damage which requires immediate repair and that which does not constitute a flight hazard.

12-2. ASSESSMENT PROCEDURES. Refer to Table 12-1.

12-3. REPAIR PROCEDURE INDEX.

	PARA.
Hose and Line Replacement O-Ring Damage	9-10 12-6

Section II. LINES AND HOSES

12-4. GENERAL.

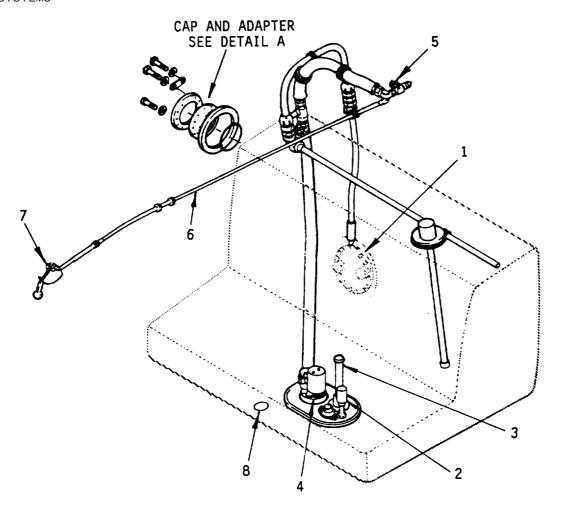
- a. Replacement lines and hoses need not be routed along the path of the original installation. They may be routed along any convenient path as long as they do not interfere with personnel or with operating equipment. Long lines and hoses should be clamped to hard supports at convenient intervals not exceeding 24 inches.
- b. Tubing in the OH-58 fuel system is limited to the fuel vent line. When damage occurs to any of the lines (tubes or hoses), they may be substituted with a flexible type hose from the kit.
- c. If hose assemblies from the kit are not available, damage may be cut out and replaced with a small section (refer to repair procedures), or a replacement

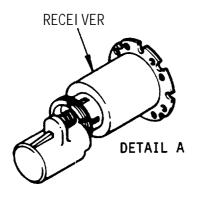
hose may be manufactured if a long enough hose section and MS fittings are available (refer to repair procedures).

- d. Never discard MS fittings, they are reusable. The MS21922 sleeve is not reusable.
- 12-5. O-RING DAMAGE. Refer to Chapter 9, paragraph 9-10. The same criteria that applies to hydraulic o-rings also applies to o-rings in the fuel system.

12-6. FUEL SUBSTITUTIONS.

- a. If the standard fuel is not available, a substitute fuel must be used. Check Appendix D for a compatible fuel.
- b. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.





NOTE

RECEIVER REPLACES CAP AND ADAPTER ON HELICOPTERS EQUIPPED WITH CLOSED CIRCUIT REFUELING PROVISIONS.

- 1. Cover Assembly

- 2. Low Level Switch
 3. Lower Transmitter
 4. Fuel Pump
 5. Fuel Shut-Off Valve
 6. Fuel Shut-Off Cable
 7. Fuel Shut-Off Lever

- 8. Auxiliary Fuel Cell Fitting

Figure 12-1. OH-58 Fuel System

FUEL SYSTEM DAMAGE IS DAMAGE WITHIN ACCEPTABLE LIMITS? NO YES NO REPAIRS IS REPAIR/REPLACEMENT FEASIBLE? NO YES REPAIR/REPLACE RECOVER FUNCTIONAL CHECK FOR CANNIBALIZE PROPER OPERATION AND DESTROY **SAFETY** HOSES AND LINES PER CHPT 9 O-RING DAMAGE PER CHPT 9 FUEL SUBSTITUTE PER SEC II

FUEL CELL DAMAGE

PER SEC II

Table 12-1. Fuel System Assessment Procedures

Section III. FUEL CELL DAMAGE

12-7. FUEL CELL DAMAGE.

GENERAL INFORMATION: The fuel cells restrict the catastrophic loss of fuel in survivable crashes. The repairs specified in this section, however, will not necessarily return the cells to their original crash resistant level. Fuel cell damage can be categorized as follows:

- a. Nonrepai rable:
- (1) Damage to metal plate of fittings on tank which causes leakage.
- (2) Damage to tank wall which exceeds 3 inches.
- (3) Damage within 2 inches of metal fitting.
- b. One-Time or Emergency Flight Capability Repair:

Mechanical Clamp Repair (option 1).

- c. 100 Flight Hour Capability Repair:
 - (1) Adhesive repair (option 2).
- (2) Flat panel repair, one plane (option 3).
 - (3) Two plane repair (option 4).
 - (4) Three plane repair (option 5).

OPTION 1: Mechanical Clamp Repair.

LIMITATIONS: Emergency flight repair.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 30 minutes

MATERIALS/TOOLS REQUIRED:

- . Mechanical Repair Sealing Clamp (3 or 5 inch)
- . Kni fe

PROCEDURAL STEPS:

- 1. Defuel the fuel cell by the following procedure:
 - a. Remove the fuel drain cover panel.
- b. Push or twist drain valve located under aircraft where fuel pump is located.
- c. Place a bucket or any type receptacle under the aircraft to catch the fuel
- 2. Locate the damage (e.g., hole or tear) on the cell.

NOTE

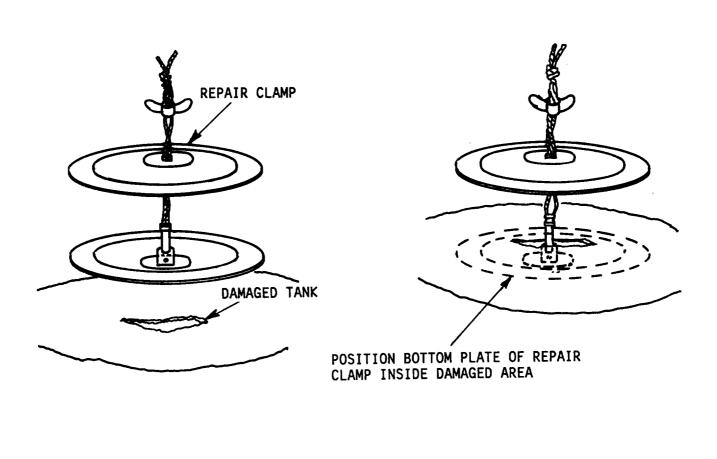
For holes less than 2 inches across, use the 3 inch clamp. For holes greater than 2 inches across but less than 3 inches across, use the 5 inch clamp. Holes larger than 3 inches are nonrepairable.

- 3. Use the knife to enlarge the hole to 3/4 inch to 2 inches maximum for a 3 inch clamp and 1 inch to 3 inch maximum for the 5 inch clamp.
- 4. Insert the bottom plate of the clamp through the hole and pull up using the cord. Position the plate so the hole is entirely within the gasket area. slip the top plate over the threaded stud and hand tighten the wing nut, Figure 12-2.

CAUTION

Excessive mechanical tightening of the wing nut can result in failure of the clamp. The wing nut shall be finger tightened, and the maximum torque on the wing nut shall not exceed 10 to 12 inch-pounds.

5. Tighten drain valve and install cover plate.



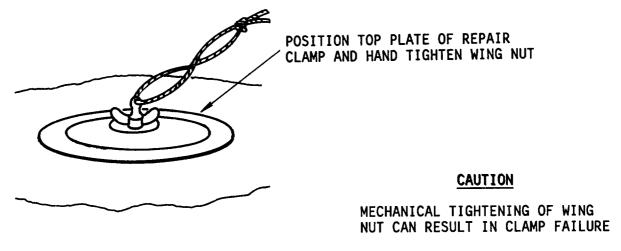


Figure 12-2. Emergency Mechanical Clamp Repair

TM 55-1520-228-BD FUEL SYSTEMS

- Refuel the aircraft.
- Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Adhesive Repair.

LIMITATIONS: Temporary repair, 100 flight hour capability. Inspect after every flight.

PERSONNEL/TIME REQUIRED:

. 1 Soldier

. 3 Hours

MATERI ALS/TOOLS REQUIRED:

Sol vent, 1-1-1 Trichloroethane or Equivalent (item 59, Appx C)

Repair Fabric

Abrasive Cloth (item 1, Appx C) Adhesive (item 3, Appx C)

Plastic Container/Cup

Wooden Tongue Depressor (item 60, Appx C)

PROCEDURAL STEPS:

- 1. Defuel the aircraft. Refer to option 1, step 1.
- 2. Once step 1 (above) has been completed, l'ocate the damage. Trim only the outer exposed damage area to provide a reasonably smooth exterior surface. DO NOT ENLARGE HOLE.
- Abrade and solvent wash the area surrounding the damage. Clean at least 4 inches beyond the damage.
- Cut a fabric patch to overlap the damaged area by a minimum of 1 inch all the way around. Soak the patch in solvent. (NOTE: No hole is required in the center of the patch.)
- 5. Mix the adhesive as described below in steps 5a thru 5h, refer to Figure 12 - 3.

CAUTI ON

Wear goggles or other eye protection during all operations.

- a. Remove the tape band from Semkit cartridge and pull the mixing rod straight up toward the top of the cartri dge.
- Squeeze cartridge slightly in area of the removed tape band to deform foil barri er.
- c. To mix dry filler to base compound, push mixing rod to bottom of cartridge and begin stroking in spiral clockwise motion from top to bottom of cartridge, rotating mixing rod approximately 90° with each stroke. Mix for the total number of strokes indicated on the instruction card accompanying each Semkit (40 strokes). A stroke is one complete in and out cycle. On last stroke, mixing rod should be fully extended.
- d. Pull mixing rod out approximately one-third of way.
- e. Insert ram rod into hole in top of mixing rod and inject about one-third of curing agent into the cartridge.

CAUTI ON

Use firm but even pressure. Do not force, tap, or jolt ram rod.

- Repeat steps a and b until all of the contents of the rod are emptied into the cartridge.
- Mix curing agent into cartridge by repeating step c.
- h. Grasp cartridge firmly at neck and unscrew mixing rod by turning counterclockwise approximately three turns. Remove mixing rod and discard.

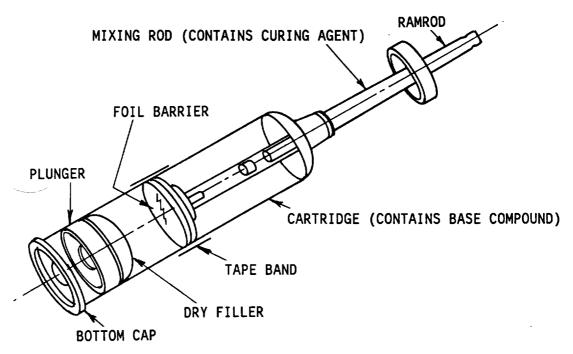


Figure 12-3. Mixing Instruction for Sealant Cartridges

- 6. Apply adhesive to the wound opening for a least 1-1/2 inches around the damaged area or enough to accept the patch cut in step 4 (above).
- Apply and smooth out in the applied adhesive a solvent soaked fabric patch to the damaged area. Apply adhesive if required to seal the patch to the tank, and smooth out the surface.

CAUTI ON

The patch will tend to slip when applying additional adhesive and Be sure to recenter smoothing. the patch.

- 8. Maintain the patch position until the adhesive sufficiently sets (approx. 30 min). (NOTE: Allow the adhesive to cure for two hours before refueling.)
- 9. Tighten drain valve and install cover plate.
- 10. Refuel the aircraft.

Record BDAR action taken. When . mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 3: Flat Panel Repair (One Plane).

LIMITATIONS: Inspect after every flight.

PERSONNEL/TIME REQUIRED:

- . 1 Soldier
- . 3 Hours

MATERIALS/TOOLS REQUIRED:

- . Knife or Scissors. Solvent, 1-1-1 Trichloroethane or Equivalent (item 59, Appx C)
- Abrasive Cloth (item 1, Appx C)
- . Repair Fabric
- . Adhesive (item 3. Appx C)
- . Plastic Cup or Other Small Container
- . Rubber Plug Kit

PROCEDURAL STEPS:

1. Defuel the aircraft. Refer to option 1, step 1.

- 2. Once step 1 of this section has been completed, locate the damage; enlarge the wound in the tank to no more than 3 inches in diameter by using a knife or scissors. Remove all frayed fabric and damaged inner lines.
- 3. Abrade the inner lines or inner surface at least 1/2 inch beyond the enlarged hole, preferably more if conditions permit. Abrade the outer surface to a minimum of 4 inches from the enlarged area. (NOTE: If the fraying fibers are too numerous, trim the fiber with scissors.)
- 4. Clean the abraded areas using towels soaked in solvent.
- 5. Cut a fabric patch 4 inches in diameter or large enough to extend at least 1 inch beyond the damaged area and add a 1/2 inch hole in the center. Soak the patch in solvent.
- 6. Mix the adhesive per option 2 instructions, step 5, and extrude into a plastic cup. (NOTE: Adhesive can be used between 20° through -120°, but must be warmed to room temperature prior to mixing and be mixed at room temperature. Pot life of adhesive is approximately 25 minutes at 70°F.)
- 7. Apply adhesive to inner liner using finger to swab cement around the wound. Apply adhesive to concave surface of the rubber plug (this is the surface the cord is attached to). Refer to Figure 12-4 for rubber plug assembly.

NOTE

Use adhesive as required, retain some for finishing the outside of the cell repair.

8. Fold the rubber plug and insert it through the hole in the cell. (NOTE: Retain cord to prevent loss of plug in the cell.)

- 9. Pull the plug into position and rotate it in position to smooth out the adhesive interface. Center the plug on the wound.
- 10. Apply a layer of adhesive 4 inches in diameter around the wound on the outside and fill in the wound with adhesive. (NOTE: There must be a minimum of a 1/2 inch bond.)
- 11. Apply the solvent soaked fabric patch to the outside surface by passing the cord through the hole in the patch and position the patch over the wound. Smooth the patch into the adhesive.
- 12. Pull the cord and tape to the structure keeping a slight tension.
- 13. Do not disturb the repair for a minimum of 30 minutes, and let cure two hours before refueling. Cut the string and plug stem without disturbing the repair.
- 14. Tighten drain valve and install cover plate.
- 15. Refuel the aircraft.
- 16. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.
- OPTION 4. Two Plane Repair. Damage to a two plane area will be repaired in the same manner described in option 3, except the hole should not be enlarged to more than 1/2 X 2-1/2 inches.
- OPTION 5. Three Plane Repair. Damage to a three plane area will be repaired in the same manner as described in option 3, except the hole should not be enlarged to more than 1/2 X 2-1/2 inches and the rubber plug will be cut as shown in Figure 12-5. This will allow the plug to assume the contour of the tank when pulled into place.

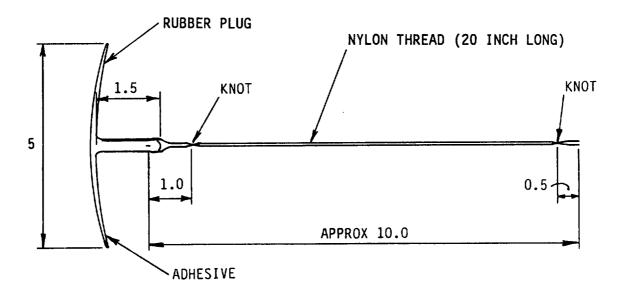


Figure 12-4. Rubber Repair Plug Assembly

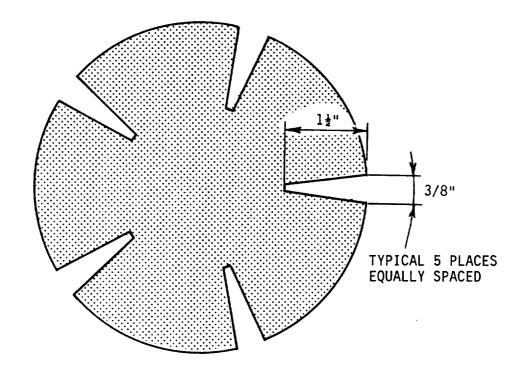


Figure 12-5. Plug Modification for Three Plane Repair

FLIGHT CONTROLS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

13-1. GENERAL.

- a. The flight control system is made up of the main rotor collective controls, cyclic controls, and the tail rotor controls. The tail rotor pedals are connected to the tail rotor assembly.
- b. This chapter contains some BDAR procedures which may be used to accomplish repairs to the flight control tubes. Flight control tubes connect the copilot's and pilot's cyclic, collective,

and tail rotor controls to the aft flight control components. Refer to Figure 13-1 for a schematic of the system.

13-2. ASSESSMENT PROCEDURES. Refer to Table 13-1.

13-3. REPAIR PROCEDURE INDEX.

PARA.

Tubes, Flight Control. . . . 13-5

Section II. TUBES, FLIGHT CONTROL

- 13-4. SUBSYSTEMS AND ASSEMBLIES. There are various subsystems and assemblies within the flight control system that are vital for combat aircraft maneuverability and control but are not necessarily essential for basic flight capabilities. Refer to Table 13-1 for assessment procedures.
- a. Force Trim System. If the force trim system is malfunctioning, the aircraft is still fully mission capable with no limitations presented.

b. Control Rods.

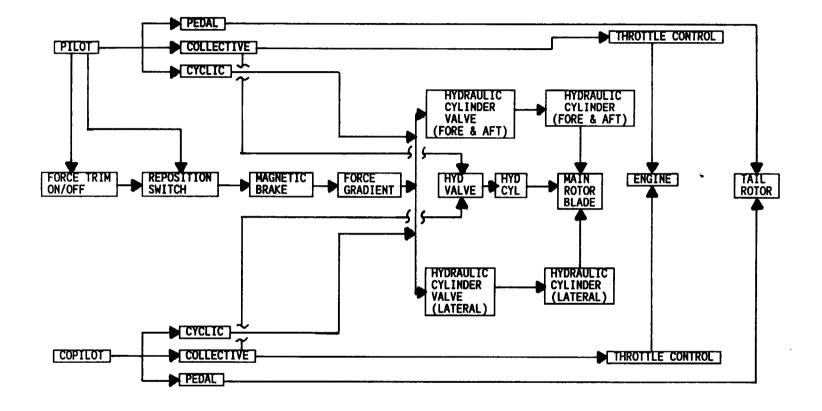
(1) Copilot to Pilot. If any control rods, bell-cranks, or linkages connecting the copilot controls to the pilot controls break or otherwise become inoperable, the pilot may assume full control for the particular function which has been damaged, provided that the damaged part does not become jammed in the surrounding aircraft structure.

Once the aircraft is on the ground, if no replacement parts are available, the control tube may be splice-repaired (refer to paragraph 13-4) or removed to avoid any possibility of the control tube getting jammed. If the tube is removed, the pilot assumes full control of the function that has been lost to the copilot.

(2) If any flight control systems, including control rods, bell-cranks, linkages, hydraulic cylinders, etc., which lie between the pilot and the main rotor blade or tail rotor blade sustain damage during flight, the aircraft will be uncontrollable and forced to crash land.

13-5. TUBES, FLIGHT CONTROL.

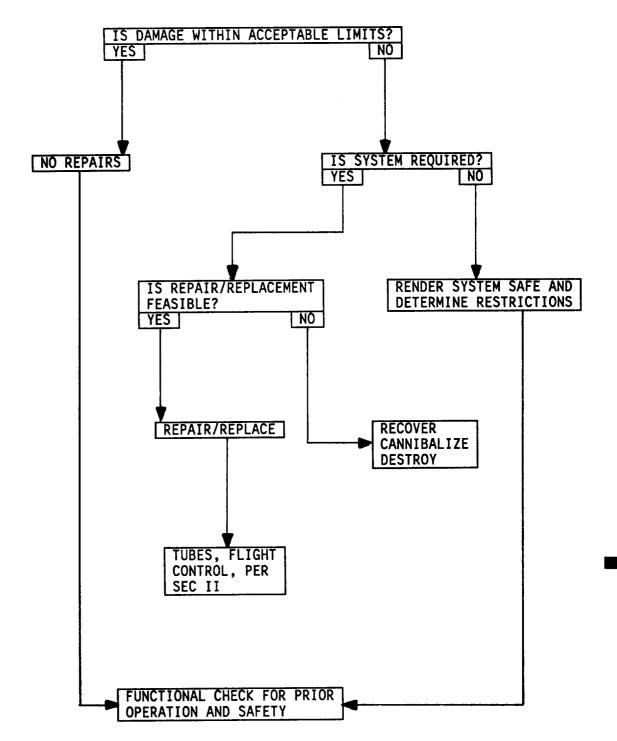
GENERAL INFORMATION: The following repair procedures may be used to accomplish repairs to flight control tubes. Flight control tubes connect the



TM 55-1520-228-BD FLIGHT CONTROLS SYSTEM

Figure 13-1. OH-58 Flight Controls Schematic

Table 13-1. Flight Control System Assessment Procedures



TM 55-1520-228-BD FLIGHT CONTROLS SYSTEM

copilot's and pilot's cyclic, collective, and tail rotor controls to the aft flight control components. See Figure 13-1 for a schematic of the system, and refer to Figures 13-2 thru 13-5 for a complete detail on each individual system and Figure 13-6, Table 13-2, for dimensions of tubes. Make all necessary repairs on all flight control tubes using one of the two options provided in this section. Insure that splice repairs, option 1, do not cause any interference at bulkhead lighting holes or adjacent components.

OPTION 1: Splicing, Tubes, Flight Control.

LIMITATIONS: Inspect after every flight.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 2 Hours

MATERIALS/TOOLS REQUIRED:

- Metal Sleeve
- Angle Stock
- Bolts

PROCEDURAL STEPS:

- 1. Put aircraft flight control system into neutral rig.
- 2. Disconnect and remove damaged control tube from aircraft.
- 3. Trim damaged area.
- 4. Using Table 13-2 and Figures 13-2 thru 13-5, select a metal splice, either inner or outer whichever is more suitable, and drill at least two bolt/rivet holes on each end of the tube. Refer to Table 13-3 for bolt/drill sizes to use on different size tubes. Holes should go through the splicer and the damaged tube, and should be positioned in a cross pattern, Figure 13-7. Make sure that the original center to center, length b, Figure 13-6, is maintained.

- 5. Reinstall tube after repair is accomplished, and check for binding or interference by manually moving the appropriate controls: cyclic, collective, or pedals.
- 6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Fabricating, Tubes, Flight Control.

LIMITATIONS: Inspect after every flight.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 3 Hours

MATERI ALS/TOOLS REQUIRED:

- Tube Stock (about same dia. as original tube, 0.032 in. min. wall thickness)
- Drill and Bit

PROCEDURAL STEPS:

- 1. Put aircraft flight control system into neutral rig.
- 2. Remove damaged flight control tube, Figure 13-8.
- 3. On the end that fits into the clevis bolt, mash the tube so that it fits into the arms of the clevis. A small amount of clearance between the clevis arms should be allowed, Figure 13-9. Round off the end of the mashed tube, Figure 13-10. Drill a hole through the tube and install the bolt.
- 4. On the end where the clevis bolt would normally fit, mash the tube only enough to fit over the bearing assembly with some clearance. Round off the end of the tube, Figure 13-11.

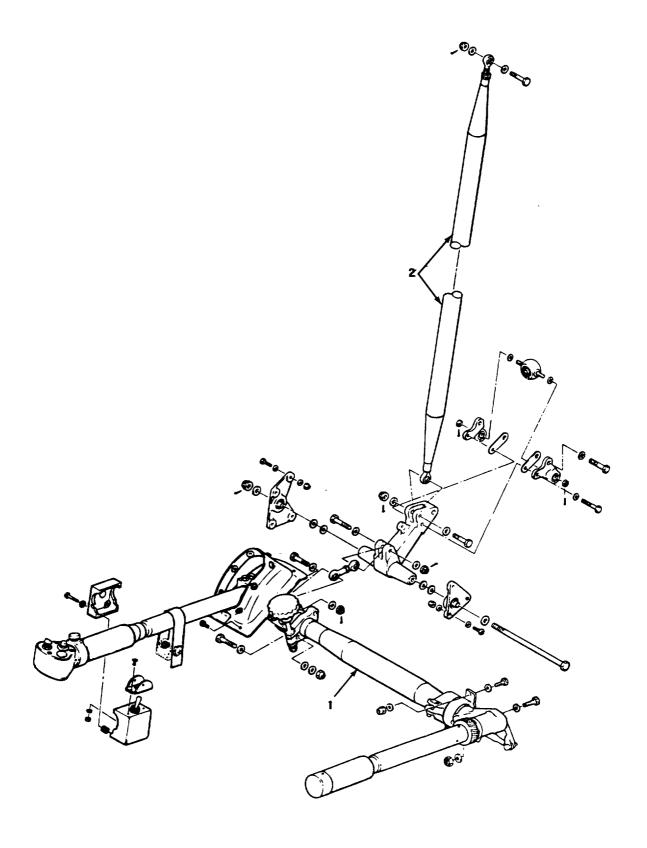


Figure 13-2. Collective Flight Control

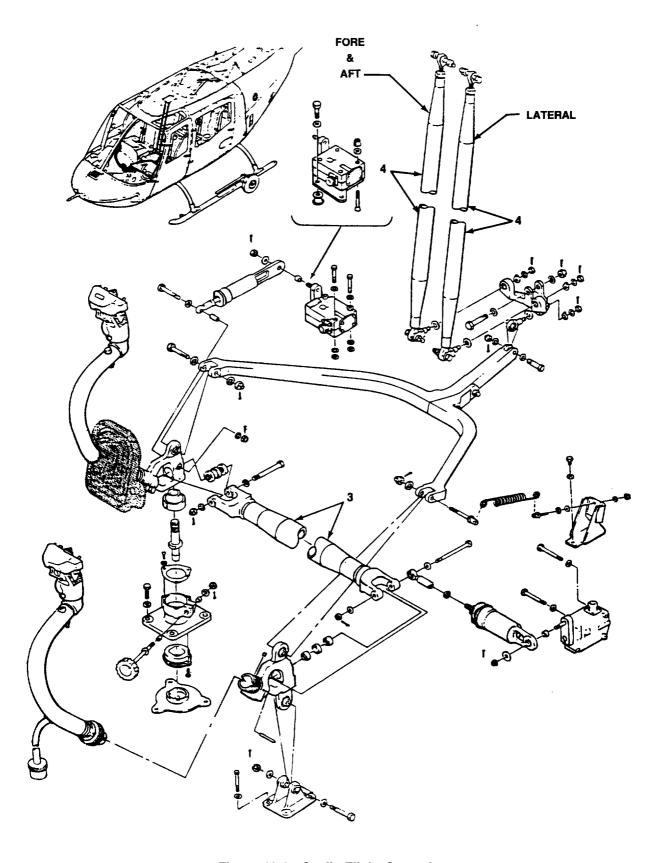


Figure 13-3. Cyclic Flight Control

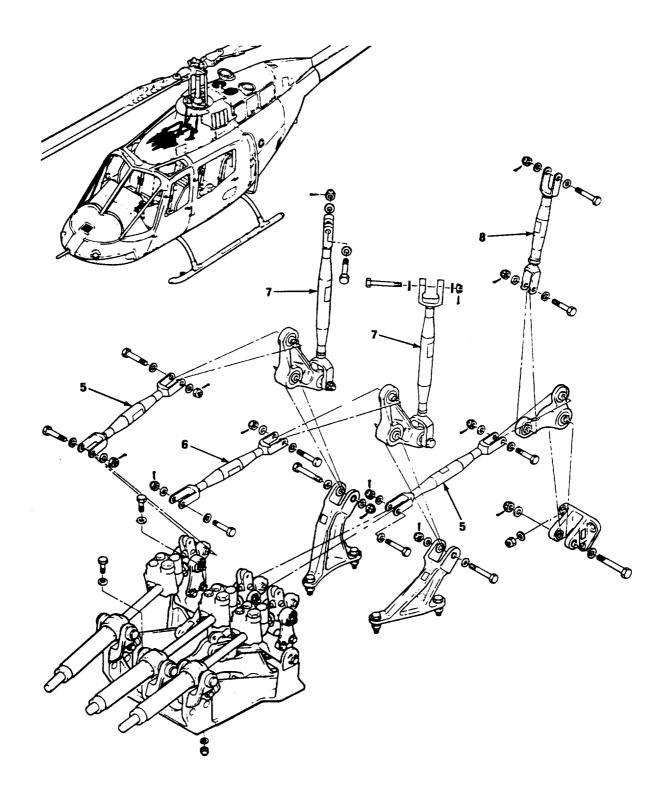
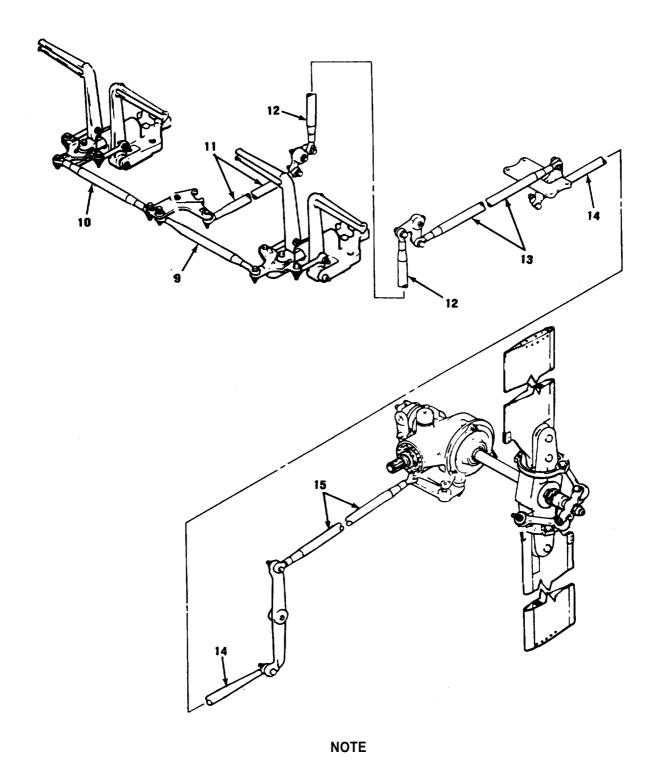
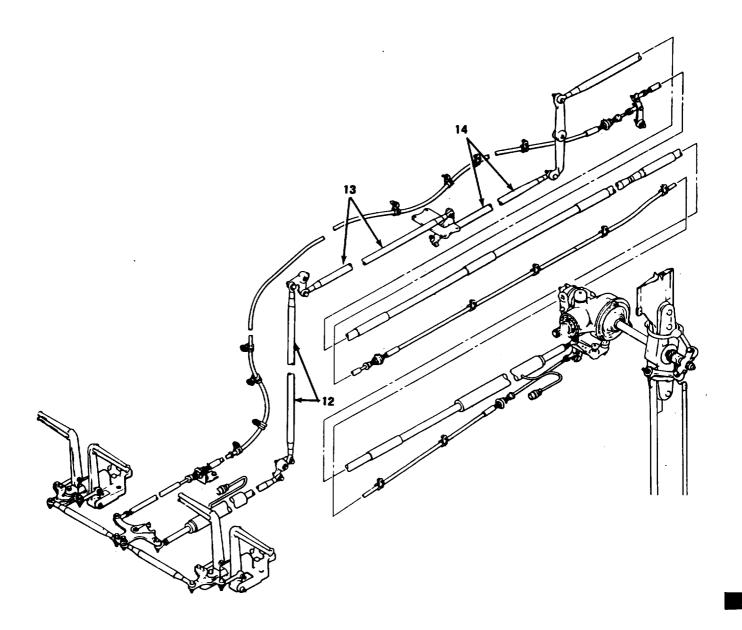


Figure 13-4. Flight Control Actuators



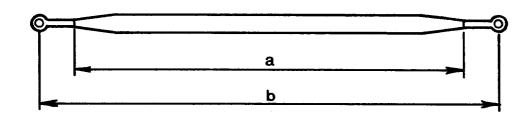
THIS IS A CONFIGURATION OF THE OH-58A SERIES HELICOPTER.

Figure 13-5. Anti-Torque Controls (Sheet 1 of 2)



NOTE

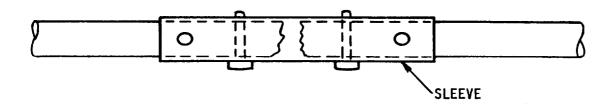
THIS IS A CONFIGURATION OF THE OH-58C SERIES HELICOPTER.



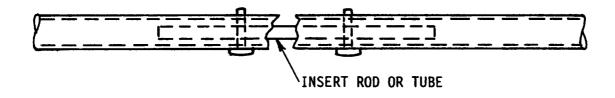
(Refer to Figures 13-2 thru 13-5)

Figure 13-6. Control Tube Dimensions

SLEEVE OVER ROD OR TUBE



INSERT ON TUBE



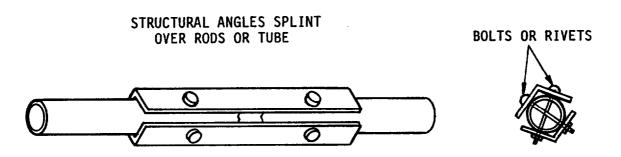


Figure 13-7. Suggested Repair for Control Rods or Tubes

Table 13-2. Nominal Tube Splice Sizes

			PART	SIZE		LENGTH (IN		IGTH (IN)
NO.	FIG	NSN	NUMBER	O.D.	I.D.	WALL	а	b
1	13-2	1680-00-125-8871	206-001-174-3	1	15/16	.065	22	-
2	13-2	3040-01-010-6779	206-001-096-7	1 3/8	-	-	41.9	-
3	13-3	3040-00-179-6880	206-001-306-11	2	1 15/16	.049	19.7	25.2
4	13-3	3040-01-012-5969	206-001-096-1	1 3/8	-	-	46.1	48.4
5	13-4	3040-01-017-7587	206-001-194-5	3/4	-	-	6.5	10.5
6	13-4	3040-01-007-5514	206-001 -194-1	-	-	-	7.2	11.4
7	13-4	3040-01-018-9710	206-001 -099-1	3/4	-	-	9.1	13.9
8	13-4		206-001-189-5	3/4	-	-	5.25	10.25
9	13-5	3040-00-483-8616	206-001-020-67	5/8	9/16	.035	11.2	12.65
10	13-5	3040-00-024-4146	206-001-020-69	5/8	9/16	.035	9.5	11.0
11	13-5	3040-00-129-6163	206-001-020-59	1 1/8	1 1/16	.035	45.4	46.8
12	13-5	3040-00-129-6137	206-001-020-29	1 1/8	1 1/16	.035	46.6	48.0
13	13-5	3040-00-129-6142	206-001-020-33	1	15/16	.035	38.8	40.2
14	13-5	3040-01-006-4907	206-001-096-25	7/8	13/16	-	51.4	-
15	13-5	3040-00-129-6135	206-001-021-13	7/8	13/16	.035	167.3	168.65
		NINENOIONO ADE IN I			<u> </u>			

NOTE: ALL DINENSIONS ARE IN INCHES

Table 13-3. Recommended Bolts and Drill Hole Sizes for Splice Repair

LINK NOMINAL	MINIMU	M BOLT SIZE	MAXIMUM BOLT SIZ		
O.D.	FOR BOLT	DRILL HOLE	FOR BOLT	DRILL HOLE	
5/8	No. 6	5/32	No. 8	3/16	
3/4	8	3/16	10	7/32	
7/8	10	7/32	1/4	9/32	
1	10	7/32	1/4	9/32	
1/8	10	7/32	1/4	9/32	
1-1/4	1/4	9/32	5/16	11/32	
1-3/8	1/4	9/32	5/16	11/32	
1-1/2	5/16	11/32	3/8	13/32	

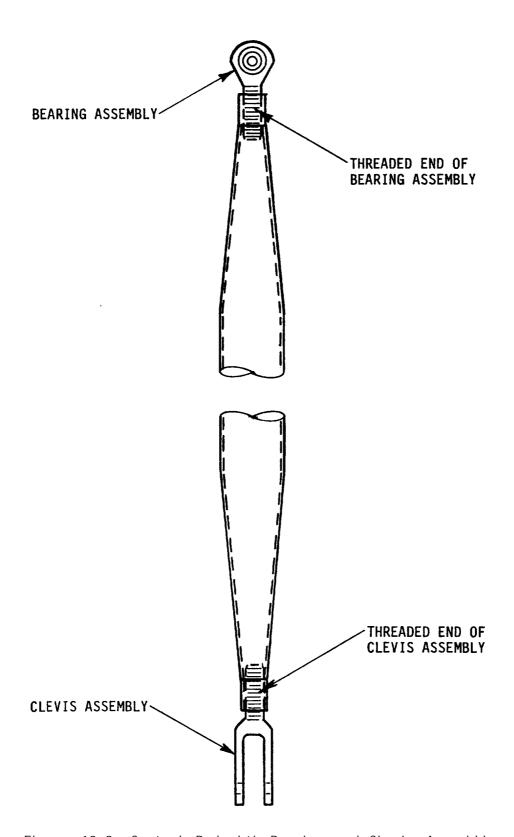


Figure 13-8. Control Rod with Bearing and Clevis Assemblies

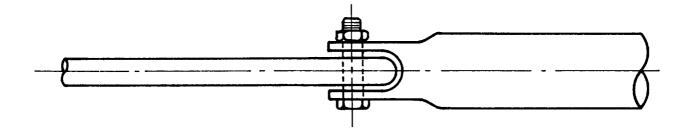


Figure 13-9. Flattened End of Fabricated Flight Control

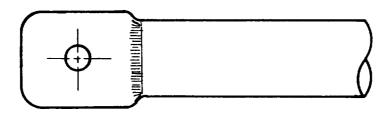


Figure 13-10. Corner Rounding on Fabricated Flight Control

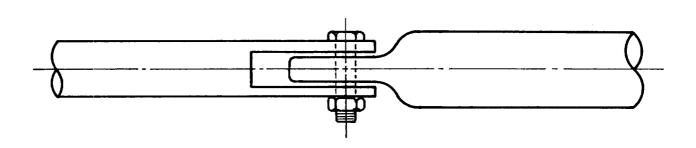


Figure 13-11. Bearing Assembly Connection of Fabricated Flight Control

TM 55-1520-228-BD FLIGHT CONTROLS SYSTEM

- 5. From Table 13-2, determine the correct distance between holes of the flight tube. Mark this distance. Drill the hole and install the bolt.
- 6. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

UTILITY SYSTEM

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)

IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

14-1. SCOPE.

- a. The de-icing system is the means by which the engine is kept from an icing condition. The system consists of a de-ice switch and a de-ice control actuator protected by a 5 amp circuit breaker. Refer to Figure 14-1.
- b. This chapter consists of two BDAR fixes which can be applied for repair of the de-icing system components.
- 14-2. ASSESSMENT PROCEDURES. Visually inspect the damaged de-icing components to determine the extent of damage and the repair required.
- 14-3. REPAIR PROCEDURE INDEX.

PARA.

Section II. DE-ICE VALVE OR CONTROL

14-4. GENERAL INFORMATION: Damage to control rod may be repaired by using one of the following repair options.

OPTION 1: Splice Repair.

LIMITATIONS: None.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 2 Hours

MATERIALS/TOOLS REQUIRED:

- Flat or Round Piece of Material (Example: engine cowl hold open rod)
- Drill with Bit
- No. 8 screws or bolts

PROCEDURAL STEPS:

1. Drill hole on end of control rod. Insure that original length of damaged rod is known. Cut substitute tube to proper length and drill hole on other end. Install substitute tube and secure with screw or bolts and nuts.

2. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Manual Control of Valve.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 1 Hour

MATERIALS/TOOLS REQUIRED:

• 0.041 or 0.032 Safety Wire

PROCEDURAL STEPS:

- 1. Remove damaged control rod from de-ice valve and control actuator. If extremely cold weather, secure de-ice valve control lever in open position by tying the lever to an adjacent part of the engine nose area. If hot weather, secure valve in closed position with safety wire.
- 2. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

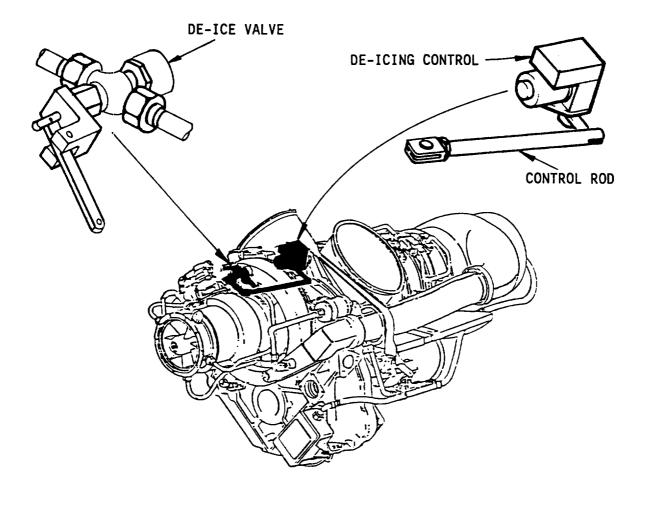


Figure 14-1. Engine De-Ice System

ENVIRONMENTAL CONTROL SYSTEM

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

15-1. SCOPE. This chapter contains BDAR procedures for the heat and vent, bleed air, and defogging systems. The OH-58A/C has one of three types of heat systems: bleed air, Figures 15-1 thru 15-3; combustion heater, Figure 15-4; or shroud heater system, Figure 15-5.

15-2. GENERAL.

- a. The three systems consists of air mixing valve, air distribution ducts, defroster nozzles, and control switches to operate system.
- b. The heat and vent system is provided for crew comfort. This aids the mission proficiency; however, the aircraft capability is not contingent on system operation. The aircraft is fully flight capable without the system being operable.

c. The shroud heater system utilizes a carbon monoxide (CO) indicator located at the instrument panel in full view of the pilot.

WARNI NG

If CO indicator is noted to be dark, turn off heater, pull firewall shut-off open vents, and land as soon as practicable.

15-3. ASSESSMENT PROCEDURES. Refer to Table 15-1.

15-4. REPAIR PROCEDURE INDEX.

			PARA.
Rigid Plastic Ducts. Flexible Ducts			15-6
Bleed Air Lines			10-7

Section II. RIGID PLASTIC VENTILATION DUCT

15-5. GENERAL INFORMATION: Some damage to plastic ducts is repairable provided the time required to gain access to the damaged duct is feasible.

OPTION 1: Hole or Crack in Duct, Rigid Plastic.

LIMITATIONS: Inspect after every flight.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 1 Hour

MATERIALS/TOOLS REQUIRED:

- Sheet Metal Patch, 0.016 inch Thickness Minimum
- Tape, Army Green or Aluminum (item 50, Appx C)

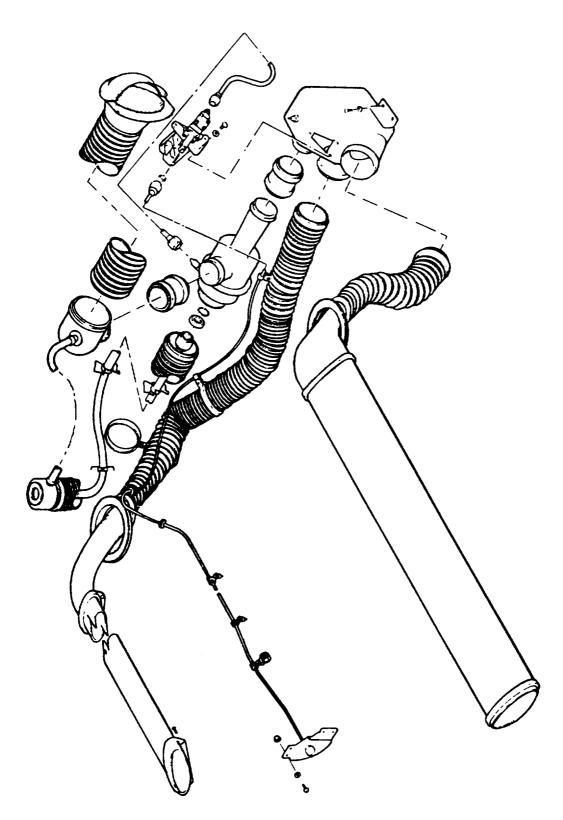
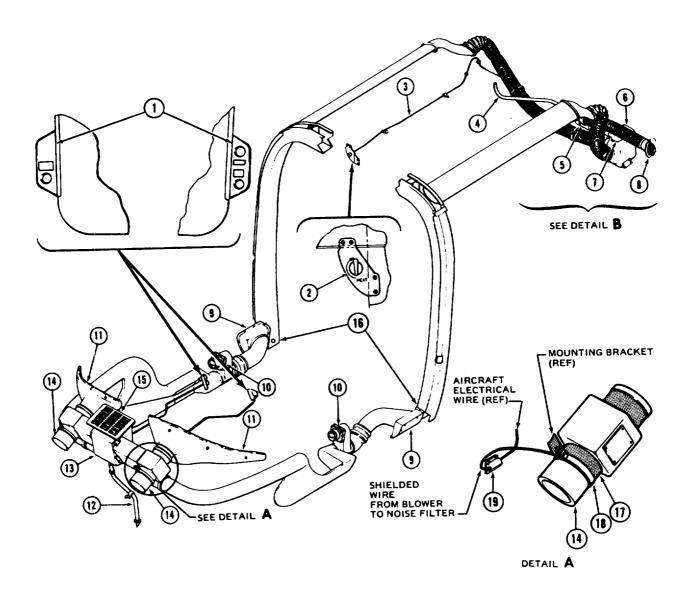


Figure 15-1. Bleed Air Heating and Ventilating System A & C

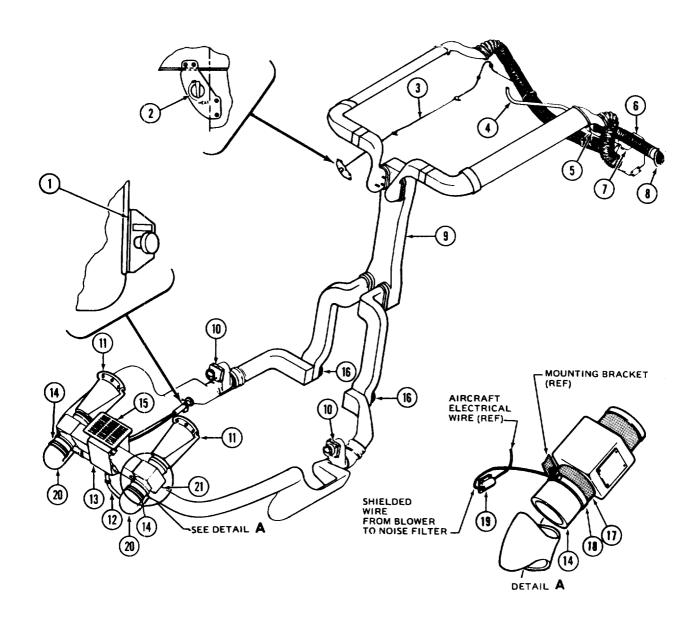


- 1. Vent and Defog Control
- Heat Control
- Heat Control Cable
 Bleed Air Tube
- 5. Mixing Valve
- 6. Plenum
- 7. Remote Sensor
- 8. Fresh Air Inlet
- 9. Post Plenum
- 10. Air Distribution Valves

- 11. Windshield Defog Nozzle 12. Plenum Drain

- 13. Plenum Valve Assembly14. Ventilating and Defogging Blower
- 15. Ram Air Intake Grill
- 16. Air Distribution Vents
- 17. Coupling
- 18. CI amp
- 19. Noise Filter
- 20. Tube

Figure 15-2. Heating and Ventilating System (Bleed Air) A Model



- 1. Vent Control
- 2. Heat Control
- 3. Heat Control Cable
- 4. Bleed Air Tube
- 5. Mixing Valve
- 6. Plenum
- 7. Remote Sensor
- 8. Fresh Air Inlet
- 9. Center Post Duct
- 10. Air Distribution
- 11. Windshield Defog Nozzle

- 12. Plenum Drain
- 13. Plenum Valve Assembly
- 14. Ventilating and Defogging Blower
- 15. Ram Air Inťake Grill
- 16. Air Distribution Valves Cargo/Passenger Area Coupling
- 17.
- 18. Clamp
- 19. Noise Filter
- 20. Blower Inlet Duct
- 21. Tee Valve

Figure 15-3. Heating and Ventilating System (Bleed Air) C Model

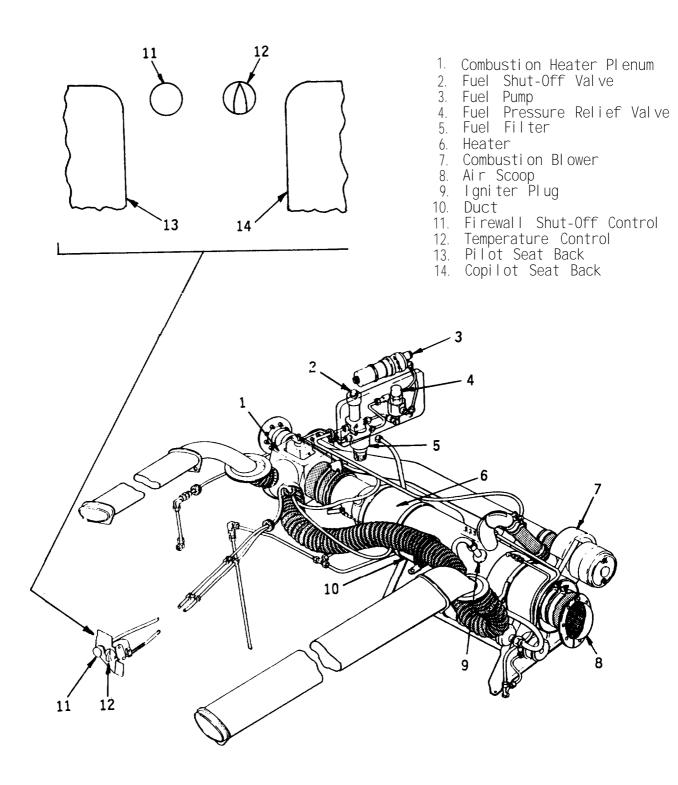
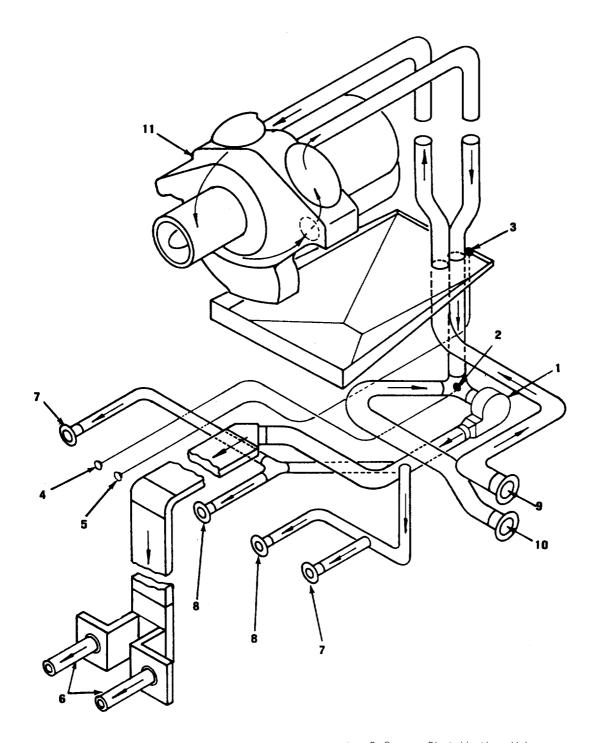
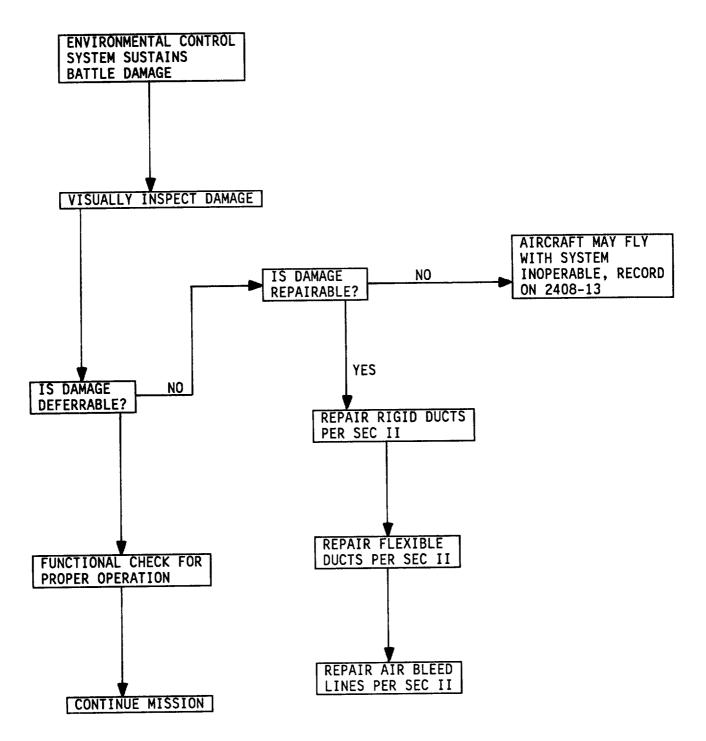


Figure 15-4. Combustion Heater



- Blower
 Air Mixing Valve
 Firewall Shut-Off Valve
 Air Mixing Valve Control
 Firewall Shut-Off Valve Control
- Defogger Distribution ValvesCockpit Distribution ValvesCabin Distribution ValvesFan Air Intake
- 10. Cold Air Intake
 11. Shroud Assembly

Table 15-1. Assessment Procedures



TM 55-1520-228-BD ENVI RONMENTAL CONTROL SYSTEM

PROCEDURAL STEPS:

- 1. Locate damaged area and remove panels and/or other items as necessary to gain access to the duct to be repaired. Refer to Figures 15-2 and 15-3 for locations of rigid plastic ducts.
- 2. Cut a patch out of sheet stock.
- 3. Tape into place.
- 4. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

OPTION 2: Hole or Crack in Duct, Rigid Plastic.

LIMITATIONS: Inspect after every flight.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 1 Hour

MATERIALS/TOOLS REQUIRED:

- 0.016 inch Sheet Metal Minimum
- Sealant (item 4, Appx C)
- 400 Grit Sand Paper (item 45, Appx C)
- Cleaner Naptha or Equivalent (item 7, Appx C)
- Glass Tape or Aluminum Tape (item 60, Appx C)

PROCEDURAL STEPS:

- 1. Locate damaged area and remove panels and/or other items as necessary to gain access to the duct to be repaired. Refer to Figures 15-2 and 15-3 for locations of rigid plastic ducts.
- 2. Cut a patch out of sheet stock. Patch should extend 1-1/2 inches from the edge of the hole at all points.

- 3. Stop drill any cracks which might be extending from hole.
- 4. Sand both the bottom surface of the patch and the surface area around the hole to be covered by the patch.
- 5. Clean surface with solvent.
- 6. Apply sealant to patch and on the surface area that will be covered by the patch.
- 7. Press patch in place, and wrap glass tape around patch and duct to hold the repair in position.
- 8. Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

15-6. FLEXIBLE DUCT DAMAGE.

GENERAL INFORMATION: The flexible ducts are composed of special wire covered fabric with impregnated rubber.

LIMITATIONS: These repairs are temporary and the damaged hoses should be replaced as soon as possible. Inspect after every flight.

PERSONNEL/TIME REOUIRED:

- 1 Sol di er
- 15 Minutes

MATERIALS/TOOLS REQUIRED:

Glass Tape or Equivalent

PROCEDURAL STEPS:

1. Locate damaged area and remove panels and/or other items as necessary to gain access to the duct to be repaired. Refer to Figures 15-2 and 15-3 for locations of flexible plastic ducts.

- 2. Wrap glass tape several turns around 3. Record BDAR action taken. When duct to cover hole or tear. Tape should mission is completed or as soon as extend beyond damaged area 3 to 4 inches in each direction.
 - feasible, replace duct using standard maintenance procedures.

Section III. BLEED AIR LINE DAMAGE

15-7. GENERAL INFORMATION. Damage to some bleed air lines may be repairable.

SYMPTOM: Loss of Engine Torque and/or High Engine Oil Temperature.

Inspect after every LIMITATIONS: flight.

PERSONNEL/TIME REQUIRED:

- 1 Soldier
- 1 Hour

MATERIALS/TOOLS REQUIRED:

- Sheet Metal Patch 0.016 in. Min.
- Sealing Compound (item 4, Appx C)
- Aluminum Tape (item 60, Appx C)
- Clamps 0.032 inch or Safety Wire 0.042 inch (item 27, Appx C)

PROCEDURAL STEPS:

Locate damaged area and remove panels and other items as necessary to gain access to the line to be repaired. Refer to Figure 15-6 for Locations of bleed air lines.

- Cut patch from aluminum sheet metal to cover hole or other damage. Patch should extend approximately 1 inch from the edge of the hole or damage at all points if possible.
- Apply sealant around the hole area to be covered by the patch.
- 4. Place patch in position, and make sure patch fills the contour of the Line.
- Secure metal patch in place using hose clamp, Figure 15-7. If hose clamps are not available, secure in place with safety wire. Turn pigtail to line.
- Wrap aluminum tape around the repair. Tape should cover at least 2 inches beyond the edge of repair.
- Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures.

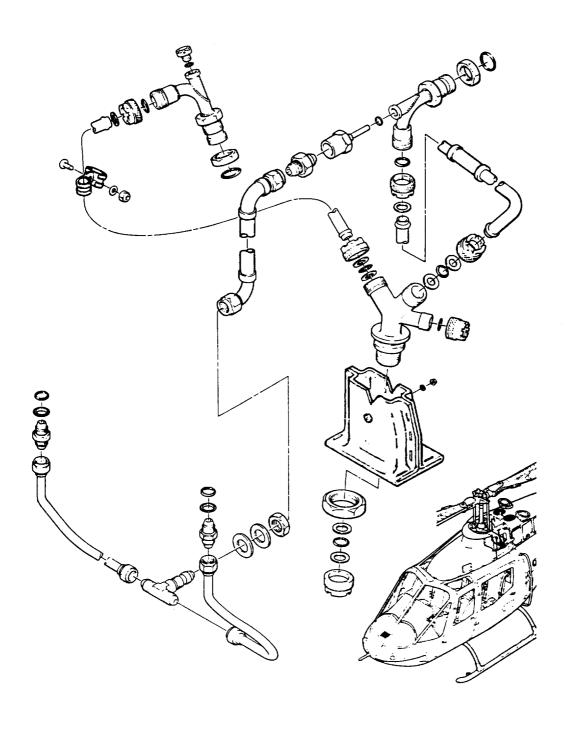
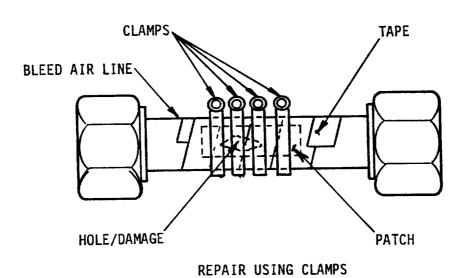


Figure 15-6. Bleed Air Line Installation



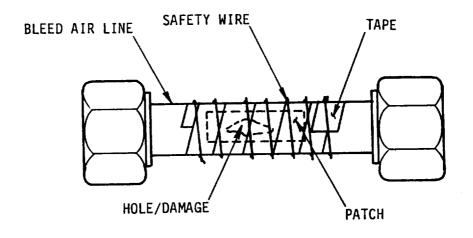


Figure 15-7. Bleed Line Patch Repair

REPAIR USING SAFETY WIRE

CHAPTER 16

MISSION EQUIPMENT

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

There are no BDAR repairs offered for the mission equipment.

•		

CHAPTER 17

EMERGENCY EQUIPMENT

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

There are no BDAR repairs offered for the emergency equipment.

APPENDIX A

REFERENCES

BOAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)

IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

The following references of the issue in effect are required for use by repair personnel to accomplish the instructions set forth in this TM.

PUBLI CATI ON NUMBER	TITLE
DA PAM 738-751	Functional User's Manual for the Army Mainte- nance Management Systems Aviation (TAMMS-A)
FM 3-5	NBC Decontamination
TM 55-1500-328-25	Aeronautical Equipment Maintenance Management Policies and Procedures
TM 55-1520-228-10	Operator's Manual Army Model OH-58A/C Helicopter Aviation Unit and Intermediate Maintenance Manual Operator's and Crewmember's Checklist

APPENDIX B

SPECIAL OR FABRICATED TOOLS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. GENERAL

B-1. SCOPE. This appendix lists special tools and test equipment. Several special tools are contained in the BDAR kits listed on the next page. The kits also contain small quantities of parts

and durable supplies not listed in other appendices. Each kit contains its own inventory list and tool usage instructions. There are no fabricated tools associated with this BDAR manual.

Section II. TOOLS

B-2. SPECIAL TOOL LISTINGS. The items listed in this appendix will enhance crew members and mechanics at all

levels to accomplish battlefield damage assessment and repairs.

TM 55-1520-228-BD APPENDIX B

SPECIAL OR FABRICATED TOOLS

TTEM NO.	NSN	DESCRI PTI ON
1	Not Assigned	Composite Structures Repair Kit
2	5935-01-161-5883 (11851) DMC658	Connector Repair Kit (Special Tools for Electrical Connector Repair)
3	4920-01-266-7535 (11851) DMC895	Emergency Repair Kit (Special and Common Tools for Electrical Repair, including Repair Parts)
4	4920-01-266-7534 (78286) 70700-20900-041	Fluid Line Repair Kit (Special and Common Tools for Tubing and Hose Repair, Including Repair Parts)
5	Not Assigned	Fuel Cell Repair Kit
6	Not Assigned	High Energy Laser Damage Analysis Test Kit
7	Not Assigned	Optical Component Repair Kit
8	Not Assigned	Standard Structures Repair Kit
9	4920-01-266-7536 (78286) 70700-20638-041	Test Equipment Repair Kit (Electrical Test Equipment)
10	5935-01-254-1688 (06090) MK-0015-1	Wire Repair Kit (Special Tools Used for Electrical Wiring Repair, Including Repair Parts)

APPENDIX C

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

C-1. SCOPE. This appendix lists expendable supplies and materials needed to make BDAR fixes on the OH-58 helicopter. Items are listed alphabetically by the item shown in the description column. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items) or CTA 8-100.

C-2. EXPLANATION OF COLUMNS.

a. Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 5, Appendix C").

- b. <u>National Stock Number</u>. This is the National stock number assigned to the item; use it to request or requisition the item.
- c. <u>Description</u>. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Commercial and Government Entity Code (CAGEC) in parentheses followed by the part number.
- d. <u>Unit of Issue (U/I)</u>. Is the abbreviation of the types of units under which material is issued.

APPENDIX C
Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

I TEM NUMBER	NSN	DESCRI PTI ON	UNIT OF ISSUE
1	5330-00-192-5051	Abrasive Cloth (Grit 180) P-C-451	PG
2	8040-00-932-1945	Adhesi ve, ENA934 NA B/A Type II, Class 3 (81348)	CN
3	8040-00-944-7292	Adhesive, Epoxy Metal Set A4 (33564) EA9340	KT
4	8030-00-723-4599	Adhesi ve, EX1675-B2 Pro Seal 890-B2	KT
5	8040-00-514-1880	Adhesive, General Purpose (81348) EC1300121	KT
6	8040-00-941-9984	Adhesive, Silicone Rubber (80244) MIL-A-46106	TU
7 8	6810-00-238-8119 7920-00-514-2417	Aliphatic Naphtha (81348) TTN95 Brush, Stiff Fiber Bristle (80244) H-B-643	GL EA
9	5940-00-280-3499	Cap, Electrical Crimp (96906) MS25274-2	EA
10	8030-00-057-2354	Chemical Conversion Coating	GL
11	4730-00-289-5909	(Alodine) (80244) MIL-C-81706 Clamp, Hose, 3/8 to 1 in. (70403) MIL-C-11569	EA
12	4730-00-908-3193	Clamp, Hose, 1-1/16 to 2 in. (01944) MS35842-12	EA
13	8030-00-231-2345	Corrosion Preventive Compound (80244) MIL-C-16173	CN
14 15	5310-00-297-3751 5940-00-296-5326	Cotter Pin Assortment (81348) Ferrul, Electrical, 22-14 Wire Gage size (10 ea) (59730)	KT EA
16	8305-00-530-0109	Fi bergl ass Cloth (81349) MI L-C-9084	RO
17	8305-00-530-0111	Fi berglass Resin (81349) MIL-C-9084	CN
18 19 20	8135-00-982-0884 5330-00-291-1605 5330-00-467-3615	Foil, Aluminum QQ-A-1876 Gasket, Cork 1/32 in. Gasket, Material 1/32 in. (81348) HH-P-96	BX SH SH
21	9150-00-944-8953	Grease, Aircraft MIL-G-81322 (54527)	CN
22	9150-00-985-7246	Grease, Aircraft Áero	CN
23	9150-00-506-8497	Shell Grease (54527) Grease, Aircraft Driveshaft	TU
24	9150-00-237-2388	Coupling Jet Engine Lubricating Oil (Grade 1010) (98308)	QT

APPENDIX C
Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST (Cont)

I TEM NUMBER	NSN	DESCRI PTI ON	UNIT OF ISSUE
25	9505-00-596-5101	Lockwire, Steel 0.020 (81348) QQ-W-423	RO
26	9505-00-293-4208	Lockwire, Steel 0.032 (81348) QQ-W-423	RO
27	9505-00-331-3275	Lockwire, Steel 0.041 (81348) QQ-W-423	RO
28	9150-00-186-6681	Lubricating Oil MIL-L-2104 (Grade 30) (15958)	QT
29	9150-00-180-6266	Lubri cati ng Oil, MIL-L-23699 (81349)	QT
30	9150-00-782-2627	Lubricating Oil, MIL-L-7808 (81349)	QT
31	5310-00-297-3751	Nut Assortment (81348) FFN836	PG
32	5330-00-966-8657	Packing, Preformed Assortment (51808) MAOK311	PG
33	9250-00-250-0926	Petroleum, Technical USP, White VV-P-236	CN
34	8010-00-082-2450	Primer, Epoxy Polyamide MIL-P-23377	KT
35	8030-00-664-4968	Putty, Chromate (81349)	RO
		MI L-P-8116	
36	5320-00-006-4912	Rivet, Blind (92215) RV1100-4-3	BX
37	5320-00-117-6826	Rivet, Blind (96906) MS2040AD4-4	ВХ
38	5320-01-033-8179	Rivet, Blind (81349) MIL-R-7885/6	BX
39	5320-01-839-2146	Rivet, B1ind (80205) NAS1738M4-3	ВХ
40	5320-01-937-5448	Rivet, Blind (11818) 3/16 in. CR2249-5-5	ВХ
41	5320-00-721-5211	Rivet, Solid Aluminum A470 A4-6 (88044)	ВХ
42	5330-00-060-8212	Sandpaper, 600 Grit	SH
43	5330-00-244-7201	Sandpaper, 400 Grit, A-A-1200	SH
		(58536)	
44	5330-00-721-8117	Sandpaper, 180 Grit, A-A-1200 (80244)	SH
45	5350-00-224-7203	Sandpaper, 320 Grit, A-A-1047 (58536)	SH
46	5350-00-619-9167	Sandpaper, 80 Grit, PP101 (81368)	SH
47	6850-00-264-9038	Sol vent,Cl eani ng,P-D-680(81348)	BBL
48	5940-00-500-8723	Splice, Conductor, Crimp Style Wire Size 10, MS25181-3 (96906)	EA
49	5970-00-419-8723	Tape, Electrical, Black Insulation	R0
50	7510-00-074-5124	Tape, Green (58536) A-A-1586	RO
51	5970-00-812-7387	Tape, Tefl on (82577)	RO RO
52	7510-00-266-6712	Tape, A-A-883 (58536)	RO RO
53	7510-00-250-0712	Tape, A-A-113 (58536)	RO RO
JJ	1010 00 104 2022	14po, 1111 (00000)	110

APPENDIX C
Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST (Cont)

I TEM NUMBER	NSN	DESCRI PTI ON	UNIT OF ISSUE
54	5940-00-283-5380	Terminal, Lug Crimp Style Stud, Size 6, Wire Gage 16-14	ВХ
55	5940-00-143-4780	Terminal, Lug, Črimp Style Stud, Size 10, Wire Gage 16-14	ВХ
56	5940-00-143-4777	Terminal, Lug (81349) MIL-T-7928	ВХ
57	5940-00-804-9184	Terminal, Quick Disconnect Wire Gage 16-14, MS27429-2 (96906)	ВХ
58	5940-00-804-9185	Terminál, Quick Disconnect, Size 18, MS27429-1 (96906)	ВХ
59	6810-00-664-0387	Tri chl oroethane, 1-1-1, T-620 (81348)	CN
60	6515-00-324-5500	Tongue Depressor, LLL-S-007, 20 (81348)	ВХ
61	61409-00-252-6499	Wire, Insulated, Size 14, BB74-50072 (46522)	RL
62	6145-00-435-8613	Wire, Insulated, Size 18, M81044/12-18-9 (81349)	RL

NOTE

- For expedient repair of flex hoses and metal tubes, refer to tables listed in Chapter 9.
- AMC/BDR kits contain all necessary tools, materials, and test equipment for electrical repairs.

APPENDIX D

SUBSTITUTE MATERIALS/PARTS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

- D-1. SCOPE. This appendix contains lists and tables of substitute materials and parts which can be used on the OH-58 aircraft for BDAR fixes.
- D-2. GENERAL. The lists and tables for Appendix D are made up of the following:
 - a. Essential spare parts, Table D-1.
- b. Spare and repair parts, Table D-2. thru D-3.
 - c. Fuels, Table D-4 thru D-7.
- d. Lubricants and hydraulic fluids, Table D-8.
- e. This appendix contains general information concerning types, uses, and effects of POL substitutes, and methods of purging and flushing systems.
- f. Some products are made up of chemical ingredients which are not compatible with products used on an OH-58 aircraft. Some fuels, oils, and hydraulic fluids can have an adverse effect on systems and components with the OH-58 systems; therefore, it is advisable to properly identify the product by specification number and name from cross-reference with primary and expedient products available.
- g. National stock numbers are used in conjunction with specification numbers to distinguish them from foreign products. The identification of (NATO) product numbers relate directly to U.S. Military Specification numbers and thus are considered direct replacements.

- h. In some situations, petroleum, oil, lubricant (POL) substitute products of friendly or enemy nations can be used; however, CAUTION should be exercised due to the possibility of sabotage. If there is no other alternative but to use enemy products, check for signs of contamination, discoloration, smell and thickness.
- i. Once a product under consideration is identified as described above, it will fall in one of three categories. These categories are defined as follows:
- (1) Primary products. These are basic products for which the system was designed. The system will function without limitation.
- (2) Alternate Product. These are products that closely match the primary product and may result in some reduced performance with no effect on system durability. There are no limitations on duration of use.
 - (3) Emergency/Expedient Products.
- (a) These are products that can be used for only short periods of time. These products are to be used as a last resort. These products will cause poor performance and system damage after prolonged use.
- (b) It is important that the distinction between these categories is understood. Since the choice between products could mean the difference between completing the mission and limping home.

APPENDIX D

<u>Table D-1. Essen</u>tial Spare Parts

	TUDI C D T. ESSCII	tiai spare Parts
ITEM	NATIONAL STOCK	
NO.	NUMBER	<u>DESCRI PTI ON</u>
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	2995-00-134-4543 1005-06-938-8226 6140-00-228-8447 5306-00-616-6472 5306-00-655-7443 5306-00-806-7697 5306-00-806-7697 5306-00-582-5723 5306-00-816-0948 5306-00-292-8284 5306-00-150-9083 5306-00-156-2533 5306-00-156-2533 5306-00-141-4511 1005-00-832-4549 1005-00-921-6241 2925-00-444-1186 5310-00-807-1474 5310-00-807-1474 5310-00-807-1467 5310-00-807-1467 5310-00-807-1469 5340-00-921-5135 5305-00-X86-3011 5305-00-206-2036 5310-00-167-0766	Actuator, Electro-Mech Ammunition Gage Block Ammunition Chute 7.62 Battery, Storage Bolt Bolt, NAD 1304-8 Bolt Bolt Bolt, NAS 1305-8 Bolt Bolt Bolt Bolt Bolt Bolt Bolt Bolt

			h 8	Tabl	e D						Par										
NOUN/NSN	H 5 8	H 6 A	H 1 E	H 1 S	H 1 F	A H 1 P	A H 1 T	U H 1 H	E H 1	H 1 H	U H 1 V	DIAM	H 1 E	H 1 K	U H 1 L	U H 1 F	U H 1 P	ZHZ	DIGG	A H 6	C H 4
PUMP SUBMERGED 2915-01-124-5222	х	1	Х	X	X	X		Х										X			
LI NEAR ACTUATOR 2995-00-134-4543	х																				
FORCE GRADIENT CYL. 1680-00-126-4350	х																				
I GNI TER EXCI TER 2925-00-444-1186	х																				
PRESSURE ALTIMETER 6610-00-179-5254	х		х	Х	Х	х		х													
ATTI TUDE NDI CATOR 6610-00-150-6583	х							х													
COURSE I NDI CATOR 5826-00-505-3094	х		х	х	Х	х		х													
PRESSURE ALTIMETER 6610-00-179-5242	х		x	х	Х	Х															
VERTICAL SPEED IND. 6610-00-935-4278	х		х	х	Х	х		х													
VOLTMETER INDICATOR 6625-00-003-8745	х		х	х	х	х															
PRESSURE ALTIMETER 6610-00-110-3368	x	x	x	Х	х	x		x													v
VERTICAL SPEED INDICATOR 6610-00-029-6703	х		х	х	Х	Х															
TRANSPONDER 5895-00-160-2198	х		х	Х	Х	Х		х				X						X			
MOUNT 5895-00-063-9498	х		х	х	х	х		х				х	х					×			
CONTROL 5895-00-089-4403	х	х	х	Х	Х	Х		х					Х					X			
MOUNT 5895-00-919-9513	х	х	х	Х	Х	х		х				Х	Х					X			
ANTENNA 5895-00-935-4975	х		х	х	х	Х		Х							Х			Х			

Table D-2. Spare and Repair Parts (Cont)																					
NOUN/NSN	0 H 5 8	0 H 6 A	AH1E	H 1 S	H	H 1 P	A H 1 T	U H 1	H 1	H 1 H	UH1V	UH 1 M	UH1E	H	H 1 L	UH1F	H 1 P	NHH	0 H	K H 6 4	H 4 7 1
MOUNT 5895-00-935-9582	X	X	X	Х	X	Х		Х										Х			
UHF RADIO SET 5821-00-138-7990	Х		Х	Х	Х	Х		Х													х
COMPENSATOR 6605-00-487-4773	х	Х	х	Х	х	Х		Х									Х	х			х
DI RECTI ONAL GYRO 6615-00-167-9757	х		х	Х	Х	Х		х										х			
COMPASS TRANSMITTER 6605-00-531-2992	х	х	х	х	х	х		х									х	х			х
AN/ARC-114 5821-00-935-5071	х	Х						х				х						х			
RADIO SET AN/ARC-115 5821-00-935-5072	х	Х						х				х						х			
INVERTER 5841-01-140-0941																					
ELECTRI CAL I NDI CATOR 6620-01-065-3740	х		х	х	х	х	х														
HOT ALR MEXING VALVE 4810-01-089-4105	х																				
N' I NDI CATOR, GAS PRODUCER 6620-01-032-3937	х																				
INDICATOR TURN & BANK 6610-00-169-1627	х		х	Х	х	Х		х													
MAGNETIC BRAKE 1680-00-909-8098	х		х	Х	Х	Х		х	х	х	х	Х	х		х	х	х	х			
PRESSURE ALTIMETER 6610-00-935-4323	Х		х	Х	Х	Х			х												х
ATTI TUDE NDI CATOR 6610-01-029-6702	Х		Х	Х	Х	Х															
ICS 5895-00-895-4175	Х	Х	х	Х	Х	Х		Х				Х						Х	Х		

Table D-2. Spare and Repair Parts (Cont)

NOUN/NSN	0 H 5 8	0 H 6 A	A H 1 E	A H 1	A H 1 F	A H 1	A H 1 T	U H 1	E H 1	H H 1	H 1 V	U H 1	U H 6	A H 6	C H 4						
AN/ARC-114(A) 5821-00-165-2970	х		х	х	X	X		X	''-		-	M	5	_		-	P	N X	0	4	7
ANTENNA 5985-00-892-0895			х	х	х	х				x		х				X		x			x
BATTERY 6140-01-068-8572	x		х	х	х	Х												Î			Î
BATTERY 6140-00-228-8447	x																				
IGNITER EXCITER 2935-00-064-9435	x		х	х	х	х	x	х	х	х		x	х	х	x	x					

Table D-3. Weapons

NOUN/NSN	0 H 5 8	0 H 6 A	A H 1 E	A H 1 S	A H 1 F	A H 1 P	A H 1 T	H 1 H	E H 1	H H 1 H	U H 1 V	U H 1 M	U H 1 E	U H 1 K	H 1 L	U H 1	U H 1	U H 1	H 6	A H 6	C H 4
MACHINE GUN 7.62MM 1005-00-903-0751	х	x		х	1	x						х								1	
AMMO-CHUTE FLEX 7.62 1005-00-027-4217	x	х		х		х						х									
DRIVE MOTOR 1005-00-832-4549	x			x		х						x									
FEEDER, DELINKING 1005-00-921-6241	x	х		х		х				-		x									

NOTE 1: Components marked X are 100% interchangeable and have the same NSN.

NOTE 2: All subcomponents of the major components may be removed and substituted; however, the level of disassembly must be consistent with the field tools and skill levels available.

Section II. FUELS

- B-3. SCOPE. This section explains the use of substitute fuels to be used on the OH-58 helicopter. Table D-4 lists some possible U.S. fuels in proper priority that may be used. Table D-5 lists primary or standard fuel sources and alternate fuel sources for various countries. Table D-6 lists some commercial fuel sources that may be substituted for the primary or standard JP-4 fuel and also some alternate fuel sources which are similar to JP-5 and JP-8.
- B-4. GENERAL. When fuel is pumped into a combustion chamber with the correct air mixture, it can be ignited and will burn in a controlled manner. The special additives the fuel contains prevents carbon deposits and corrosion build up which in turn helps engine performance.

B-5. MANNER OF BLENDING FUELS.

- a. The fuel to be used on an OH-58 helicopter has to meet certain characteristics so that starting and performance will be satisfactory. These criteria are viscosity, pour point, and cloud point.
- b. Some substitute fuels which alone cannot be used on the OH-58 helicopter can be blended with a primary fuel and can then be utilized for engine operation.

- c. When using substitute fuels, it is preferable to premix the fuels in a container for better blending before pouring into tank. This method of mixing the primary fuel with a substitute fuel insures that the fuels mix completely. The best expedient fueling method is to add both fuels at the same time from two separate fuel lines. Table D-7 lists alternate and expedient fuel blends.
- d. There is no special limitation on the use of Army standard fuel or alternate fuel. When using an emergency fuel, a fuel mixture which contains over 10 percent leaded gasoline is considered to be all leaded fuel. When using an emergency fuel, an entry on the faults and remarks column of DA Form 2408-13, Inspection Record, should be made. The entry should annotate the type of fuel, additives, and duration of operation.
- e. Fuels having the same NATO code number are interchangeable, and fuels conforming to ASTM-D-1655 specification may be used when standard fuel MIL-T-5624-JP4 is not available. Refer to Table D-4.

Table D-4. Substitute Fuels for JP-4 Fuel

	<u> </u>	<u>tute Fuels for JP-</u>	4 Fuel	_
PRIMARY FUEL	ALTERNATE FUEL	EXPEDI ENT FUEL	MILITARY SPECIFI- CATION	COMMERCIAL SPECIFI- CATION
Aviation Tur- bine: MIL-T- 5624(JP4) NATO-F-40			Х	
1001 40	MIL-T-5624(JP-5) NATO-F-44		Х	
	Aviation Turbine: ASTM-D-1655 (Jet B)			X
	Aviation Turbine: MIL-T-83133 (JP-8) NATO-F-34		X	
	Aviation Turbine: ASTM-D-1655 (Jet A-1)		Х	
		Kerosene: ASTM-D-3699		Х
		Kerosene: NATO-F-5B	Х	
		MI L-G-5572 (Any AVGAS) NATO-F-12, F-18, F-22	Х	

	Table D-5. Fuels for	The OH-58 Helicopter	
Source	Primary or Standard Fue	l Al ternate	Fuels
U.S. Military Fuel			
NATO Code No.	JP-4(MIL-T-5624)	JP-5(MIL-T-5624)	JP-8(MIL-T-83133)
FOREIGN FUEL	NATO F-40	NATO-44	NATO-34
	TURBI NE FUEL,	TURBI NE FUEL,	TURBINE FUEL,
PRODUCT	AVIATION TYPE:	AVIATION:	AVI ATI ON:
DESCRI PTI ON	Wide cut type	High Flash Type	Kerosene Type
	+(S-748)	-	+(S-748)
BELGI UM	BÀ-PF-2B AMD.2	BA-PF-6	
	a/AF	n/AF	BA-PF-7 (AF)
CANADA	3-GP-22F n/AF	3-GP-24h n/(AF)	
DENMARK	MI L-T-5624		D. Eng. RD. 2453
	Grade JP-4 a/AF		Iss. 3Amd. 2 n/a/(AF)
FRANCE	AIR 3407/B AF		AIR 3405/C n/a/AF
FEDERAL REPUBLIC	TL 9130-006 Iss. 4	TL 9130-007 Iss. 4	
OF GERMANY	n/a/AF	n/(AF)	
GREECE	MIL-T-5624		
	Grade JP-4 n/AF		
TTALY	AA-M-C. 142p	AA-M-C. 143b	AA-M-C. 141d
	n/a/AF	n/(AF)	Amd.1 (AF)
LUVENDOUDO			
LUXEMBOURG	MIL T 5704	D	DD 0450
NETHERLANDS	MI L-T-5624	D. Eng. RD. 2498	D. Eng. RD. 2453
NODWAY	Grade JP-4 a/AF	Iss. 6Amd.2 n/(AF)	Iss. 3Amd. 2 a/AF
NORWAY	MI L-T-5624		
DODTHOM	Grade JP-4 AF		
PORTUGAL	MI L-T -5624		ALD 0405 /0 AE
TUDIE	Grade JP-4 AF		AIR 3405/C AF
TURKEY	MI L-T-5624		
TINI TER IVI NORON	Grade JP-4 a/AF		
UNITED KINGDOM	D. Eng. RD. 2454	D. Eng. RD. 2498	D. Eng. RD. 2453
	Iss.3Amd.2 n/a/AF	lss.6Amd.2 n/a/(AF)	Iss. 3Amd. 2 a/AF
UNITED STATES	MI L-T-5624	MI L-T-5624	MI L-T-83133
	Grade JP-4 n/alAF	Grade JP-5 n/(AF)	JP-8
	GOST 1842-52		
USSR	GOST 10227-62		0007 0445
	T-1, TS-1		GOST 9145-59

Table	D 6	Substitute	Commorcial	Fuols
Table	υ-ο.	Substitute	Commercial	ruers

	Table D-6. Substitute C	ommerciai Fueis	
SOURCE	PRIMARY OR STANDARD FUEL	ALTERNA	TE FUELS
U.S. MILITARY FUEL NATO CODE NO.	JP-4(MIL-T-5624) F-40	JP-5(MIL-T-2624) F-44	JP-8(MIL-T-83133) F-34
COMMERCIAL FUEL (ASTM-D-1655)	JET B	JET A	JET A-1
American Oil Co.	American JP-4	American Type A	
Atlantic Richfield Richfield Div	Arcojet B	Arcojet A Richfield A	Arcoj et A-1 Ri chfi el d A-1
B. P. Trading	B. P. A. T. G		B. P. A. T. K.
Caltex Petroleum Corp.	Caltex Jet B		Caltex Jet A-1
City Service Co.		CITCO A	
Continental Oil Co.	Conoco JP-4	Conoco Jet-50	Conoco Jet-60
Exxon Co. U.S.A.	Exxon Turbo Fuel B	Exxon A	Exxon A-1
Gulf Oil	Gulf Jet B	Gulf Jet A	Gulf Jet A-1
Mobil Oil	Mobil Jet B	Mobil Jet A	Mobil Jet A-1
Phillips Petroleum	Philjet JP-4	Philjet A-50	
Shell Oil	Aeroshell JP-4	Aeroshell 640	Aeroshell 650
Sinclair		Superjet A	Superjet A-1
Standard Oil Co.		Jet A Kerosene	Jet A-1 Kerosene
Chevron	Chevron B	Chevron A-50	Chevron A-1
Texaco	Texaco Avjet B	Avjet A	Avjet A-1
Uni on Oi I	Uni on JP-4	76 Turbine Fuel	

Table D-7. Alternate and Expedient Fuel Blends									
BASE FUEL	EXTENDER (50% MAXIMUM)								
N	NOTE								
Fuel may be extended on an alternate basis with the following blends up to a half and half mixture.									
Any Primary Fuel	Any Alternate Fuel								
Any Primary Fuel	Any Alternate Fuel								
Any Primary or Alternate Fuel	MIL-F-815 Distillate								
Any Primary or Alternate Fuel	NATO-F-76 Navy Distillate								
Any Alternate or Primary Fuel	Dry Cleaning Solution: P-D-680 (Type I and II)								
	Dry Cleaning Solution: AMSTM-D-484 (K, I, II, III, IV)								
	Petroleum Spirits: ASTM-D-235 (I, II, III, IV)								

CAUTION

The helicopter shall not be flown when emergency fuel has been used for a total cumulative time of 50 hours.

Section III. LUBRICANTS AND HYDRAULIC FLUIDS

D-6. SCOPE. This section lists primary, alternate, and expedient lubricants and hydraulic fluids.

D-7. GENERAL.

- a. The lubricants and hydraulic fluids used in OH-58 systems and components must have a compatible base composition, as well as good additive level. Being that the purpose of lubricants and hydraulic fluids is to reduce wear, support bearing loads, and provide cooling, their chemical composition must be compatible. In addition to lubricating, hydraulic fluids must transmit power and motion. If two incompatible hydraulic fluids are mixed, there is a tendency of a gel substance forming within the system and ruining it.
- b. Some lubricants will not withstand OH-58 temperatures or loads for extended periods of time. These type of lubricants do not contain the necessary base properties for withstanding long term performance; therefore, they are recommended only as a last resort.
- c. Expedient lubricants can cause one of three problems.
- (1) They may not allow proper efficient operations because of improper viscosity.

- (2) They may allow an increase in wear because of improper viscosity.
- (3) They may cause seals to swell or create deposits because of improper composition.
- D-8. LUBRICANTS AND HYDRAULIC FLUIDS. Table D-8 lists the primary lubricants and hydraulic fluids which are used as primary, alternate, and expedient uses on the OH-58 helicopter.

CAUTION

Lubricating oil MIL-L-23699 shall not be used in ambient temperatures below minus 32°C/25°F.

NOTE

It is not advisable to mix MIL-L-7808 and MIL-L-23699 oils, except during an emergency. If oils are mixed, the system should be flushed within six hours. An entry on DA Form 2408-13 is required when the oils are mixed. Hydraulic oils MIL-L-83282 and MIL-L-5606 should not be mixed except during an emergency. When these oils are mixed with each other or any other oil, a DA Form 2408-13 entry is required.

APPENDIX E

BDAR FIXES AUTHORIZED FOR TRAINING

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD PROCEDURES AS SOON AS PRACTICABLE.

REPAIR PROCEDURE	PARA NO.
AI RFRAME	
Honeycomb Core Floor or Panel Damage	4-22
DRIVE TRAIN SYSTEM	
Air Duct Hose Damage	8-6
HYDRAULI C SYSTEM	
Li nes and Hoses	9-5 9-7 9-8
ELECTRICAL AND AVIONICS SYSTEM	
Splicing Unshielded Wires	11-8 11-9
Terminators for Nickel-Plated Shields (including vermilion). Terminal Boards. Terminal Lugs. Wire Bundle Tie Wraps	11-11 11-12 11-13 11-14 11-15 11-22 11-23

TM 55-1520-228-BD APPENDIX E

BDAR FIXES AUTHORIZED FOR TRAINING (Cont)

REPAIR PROCEDURE	PARA NO.
FLIGHT CONTROL SYSTEM	
Tubes, Flight Control	13-4
ENVIRONMENTAL CONTROL SYSTEM	
Rigid Plastic Ventilation Duct	15-6

APPENDIX F

AVIONICS CONFIGURATIONS

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING
AT THE DISCRETION OF THE COMMANDER.

(AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.)
IN EITHER CASE, DAMAGES SHALL BE REPAIRED BY STANDARD
PROCEDURES AS SOON AS PRACTICABLE.

Section I. INTRODUCTION

- F-1. SCOPE. This appendix lists and depicts the major components, cable routes, and wiring terminations pertaining to the OH-58 series helicopter avionics. This information is furnished as an aid to expedient repair techniques described in Chapter 11.
- F-2. GENERAL. The actual configurations may vary depending on particular requirements or changes incorporated through modification work order (MWO) action and special purpose alterations.

The Figures F-1 thru F-10 show typical location of avionics and their associated components in relation to the helicopter, and lists the component part number. Each figure also has a table associated with the avionics system which contains a complete wire listing to be used as an aid in rapid wire splicing. This includes the wire number, type (shielded, not shielded, or pair twisted with shield), end connectors, and the pin numbers on each connector.

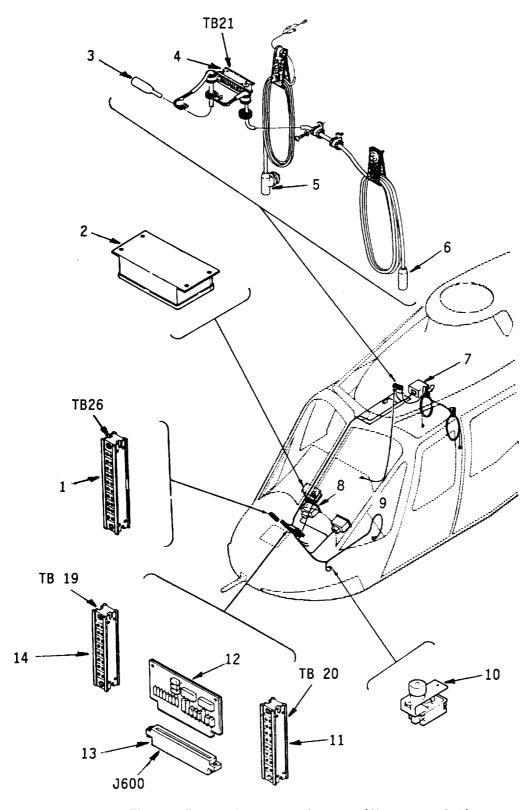


Figure F-1. Intercom System (Sheet 1 of 2)

DESI GNATI ON	PART <u>NUMBER</u>	<u>FUNCTI ON</u>
1	TJ11E-02-01	Module, Terminal Junction
2	1021-D001	Audio Threshold
3	U92AU	Jack, Telephone
4	JF13E01-02	Frame, Electronic
5	U94A/U	Plug, Connector
6	U92AU	Jack, Telephone
7	C-6533/ARC	Control, Intercom
8 9 10 11 12	C-6533/ARC C-6533/ARC MS25039-1 JF13E01-04 206-075-483-1	Control, Intercom Control, Intercom Switch, Push Rack, Electronic Network, Impedance Matching
13	PC4D2D22-4	Connector, Recepticle
14	TJ11E02-02	Terminal Board

Figure F-1. Intercom System (Sheet 2 of 2)

	-1. Wirin	g Tabl e,	Intercom	System	
WIRE NUMBER	TYPE ¹	END 1	PIN	END 2	PIN
C6533A-3A22 (RED) -1A22 (GRN) -45A22 -10A22 -14A22 -18A22	PR/S PR/S SHI ELD SHI ELD SHI ELD SHI ELD	P214 P214 P214 P214 P214 P214	C A P L R V	TB21 TB21 TB19 TB19 TB19 TB19	AZ C1 C1 A3 C3 A1
C6533B-3A22 (RED) -1A22 (GRN) -45A22 -10A22 -14A22 -18A22	PR/S PR/S SHI ELD SHI ELD SHI ELD SHI ELD	P215 P215 P215 P215 P215 P215	C A P L K V	TB21 TB21 TB19 TB19 TB19 TB19	A7 A8 D1 B3 D3 B1
C6533C-3A22 (RED) -1A22 (GRN) -45A22 -10A22 -14A22 -18A22	PR/S PR/S SHI ELD SHI ELD SHI ELD SHI ELD	P213 P213 P213 P213 P213 P213	C A P L K V	J309 J309 TB19 TB19 TB19 TB19	D2 B4 D4 B2

1 Denotes: PR/S--Pair, Twisted, with Shield

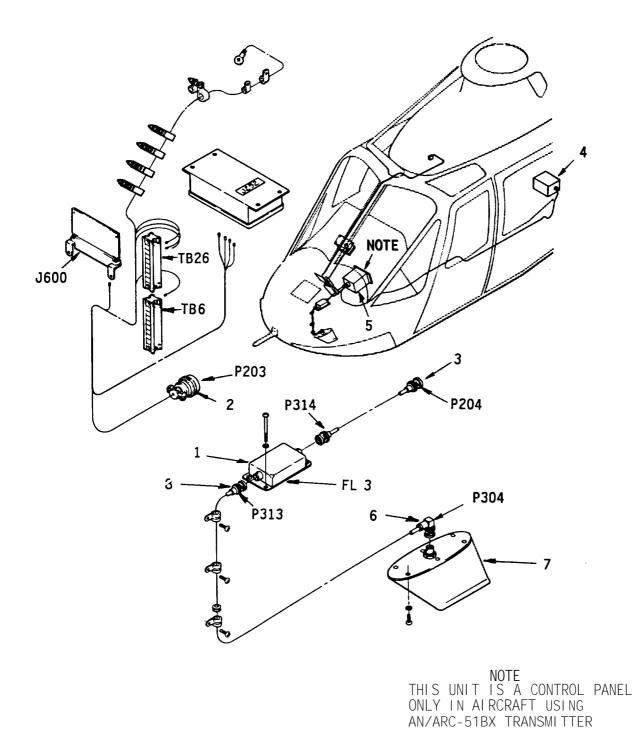


Figure F-2. UHF/AM Communication System (Sheet 1 of 2)

DRAWI NG DESI GNATI ON	PART <u>NUMBER</u>	<u>FUNCTI ON</u>
1 2	HPF40-01T	Filter, High Pass Connector, Electric
2 3	KD-59-04	Connector, Plug
4 5	AN/ARC-51BX	Transcei ver, UHF, RT-742()
5	C-6287/ARC-51BX AN/ARC-116 AN/ARC-164	Control, Panel
6	K0-59-04	Connector, Plug
7	AS2487	Antenna, UHF
8	KA-59-119	Connector, Plug Electric

Figure F-2. UHF/AM Communication System (Sheet 2 of 2)

Table F-2.	Wiring Table,			cation System	
WIRE NUMBER	TYPE ²	END 1	PIN	END 2	PIN '
OH-58A					
ARC51-124A20 -125A20 -128A20 (RED) -129A20 (BLK) -131A20 -140A	SHI ELD SHI ELD PR/S PR/S SHI ELD COAX	P403 P401 P403 P403 P403 P404	R F V E U	P401 J405 J405 J405 J405 J406	E QK L
*ARC116-10A22 -101A -101B	SHI ELD COAX COAX	P203 P204 P313	K	TB19 P314 P304	C4
*SAME WIRING USED FOR AN/ARC-164.					
OH-58C					
ARC116-10B22 (RED)	PR/S	P203	K	J252	D6
-11B22 (BLK)	PR/S	P203	L	J252	В6
-101A	COAX	P204		P314	
-101B	COAX	J313		P304	

¹ Underlined Pin Numbers Denote Lower Case.

² PR/S---Pair, Twisted, with Shield

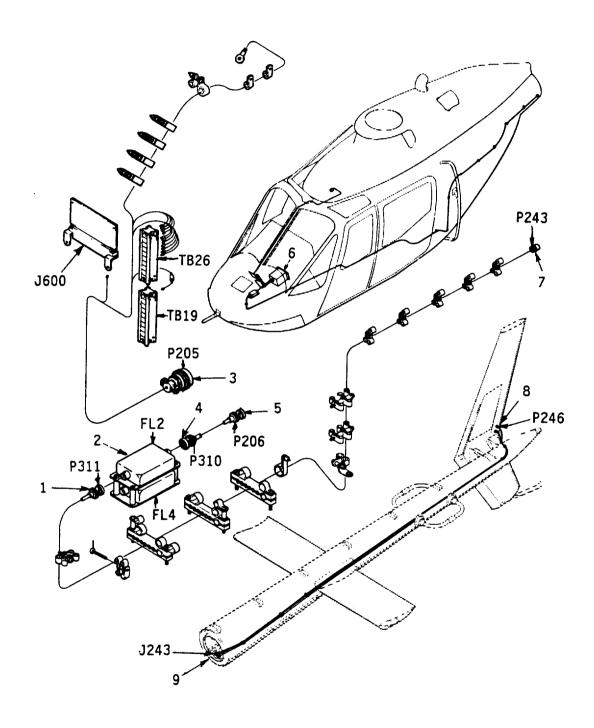


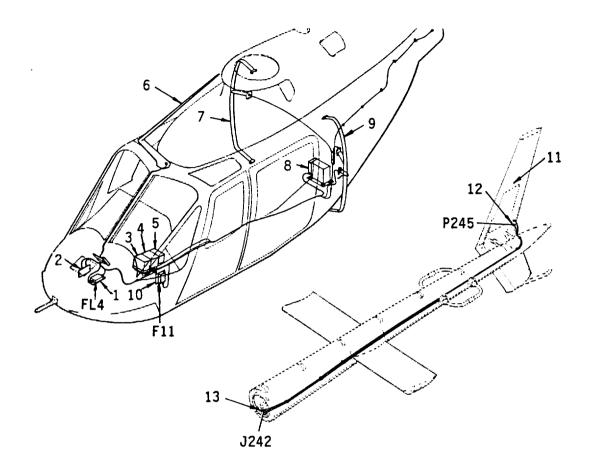
Figure F-3. VHF/AM Communication System and Connecting Cables (Sheet 1 of 2)

DRAWI NG DESI GNATI ON	PART <u>NUMBER</u>	FUNCTI ON
1	KC-59-212	Connector, Plug
2	BPF40-03P	Filter, Band Pass
3	JT06RE18-32S	Connector, Plug
4	KC-59-212	Connector, Plug
5	KD-59-04	Connector, Plug
6	AN/ARC-115	Connector, Plug
7	KC-59-196	Connector, Plug
8	KC-59-198	Connector, Electric
9	KC-19-120	Connector, Electric

Figure F-3. VHF/AM Communication System and Connecting Cables (Sheet 2 of 2)

Table F-3. Wiring Table, VHF/AM Communication System

Iable r-s. Will	ng rabie,	VIII/AIVI C	, Ollilliu i i i	zati on syst	elli
WIRE NUMBER	TYPE	END 1	PIN	END 2	PIN
0H-58A					
ARC115-10A22 -101A -101B	SHI ELD COAX COAX	P205 P206 P311	K	TB19 P310 P243	A4
ARC115-101C	COAX	J243	•	P246	
OH-58C					
ARC115-10B22 (RED] -11B22 (BLK) -101A -101B	COAX COAX	P205 P205 P206 P311	K	J252 J252 P310 P243	D5 D6
ARC115-101C	COAX	J243		P246	<u> </u>



DRAWING D <u>ESIGNATION</u>	PART <u>NUMBER</u>	FUNCTI ON
1 2 3 4 5 6 7	LPF-40-028 204-075-850-9 AN/ARC-114 AN/ARC-114 C-8157/ARC AS-2485 AS-2670/ARC	Filter, Low Pass Board, Capacitor, A3 Radio Set, No. 1 FM Radio Set, No. 2 FM Control, Indicator TSEC/KY-28 Antenna, No. 2 FM Antenna, R/H, No. 1 FM
8	TSEC/KY-28 TSECI KY-58	Com Security Set Com Security Set
9	AS-2486/ARC	
10 11	LPF40-028 206-022-114-1	Filter, Low Pass Antenna, No. 1 FM, USBL on 68-16687 thru 72-21454
12 13	206-022-114-3 KC-59-212 KC-19-120	USBL on 72-21455 and Subq. Connector, Plug Connector, Electrical

Figure F-4. VHF/FM Communication System

Table F-4.	Wiring Tab	le, VHF/FM	Communi c	ation System	l 5
WI RE NUMBER	TYPE *	END 1	PIN	END 2	PIN
OH-58A					
1ARC114-2A22 -9A22 -10A22 -11A22 -17A22 -18A22 -19A22 -26A22 -27A22 -28A22 -101A -101B -101C -102A -103A 2ARC114-10A22 -101A	SHI ELD COAX COAX COAX COAX COAX COAX COAX COAX	P209 P209 P209 P209 P209 P209 P209 P209	BJKLTUV cidiel	P201 P249 P249 P250 A3 A3 P201 P249 P250 P237 P242 P245 P241 P240 TB19 P316	V P V H 2 1 W D G K
-101B	COAX	P315		P238	
0H-58C	-	_			
1ARC114-2A22 -9A22 -10A22 -11A22 -17A22 -18A22 -19A22 -26A22 -27A22 -28A22 -101A -101B -101C	SHI ELD COAX COAX COAX	P209 P209 P209 P209 P209 P209 P209 P209	B J K L T u V C d e	P201 P249 P249 P250 A3 A3 P201 P249 P251 P250 P237 P242 P245	V P V H 2 1 K D C2 K
-102A -103A 2ARC114-11B22 (BLK) -20B22 (RED) -101A -101B	COAX COAX PR/S PR/S COAX COAX	P211 P212 P207 P207 P208 P315	L K	P241 P240 J252 J252 P316 P238	D4 C5

¹ Underlined Pin Numbers Denote Lower Case.

² Denotes: PR/S---Pair, Twisted, with Shield

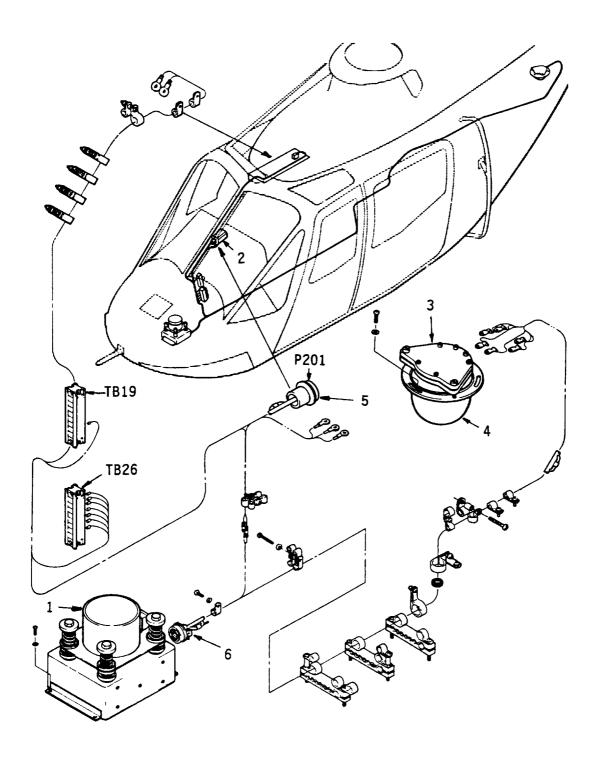


Figure F-5. Gyromagnetic Compass Set AN/ASN-43 and Connecting Cables (Sheet 1 of 2)

DRAWI NG DESI GNATI ON	PART <u>NUMBER</u>	<u>FUNCTI ON</u>
1	CN-998()/ASN-43	Gyroscope, Displacement
2	ID-1351()/A	Indicator, Heading Bearing
3	CN-405/ASN	Compensator, Transmitter
4	T-611A/ASN	Transmitter, Induction
5	MS3126E18-32S	Connector, Plug
6	MS3126E16-26S	Connector, Plug

Figure F-5. Gyromagnetic Compass Set AN/ASN-43 and Connecting Cables (Sheet 2 of 2)

Table F-5. Wiring Table, Gyromagnetic Compass Set

WIRE NUMBER	TYPE	END 1	ΡĬΝ	END 2	PIN
TN1705D22 10A22 (BLU) 11A22 (GRN) 12A22 (YEL) 13A22 14A22 15A22 20A22 (BLU) 21A22 (GRN) 22A22 (YEL)	SHI ELD TWT/S TWT/S TWT/S SHI ELD SHI ELD SHI ELD TWT/S TWT/S TWT/S	P202 P202 P202 P202 P202 P202 P202 P201 P201	V W X Y H J G F G H	P202 P201 P201 P201 P201 P201 P201 TR101 TR101 TR101	T J K L C D E B C A

1 Denotes: TWT/S---Three Wire Twisted, with Shield

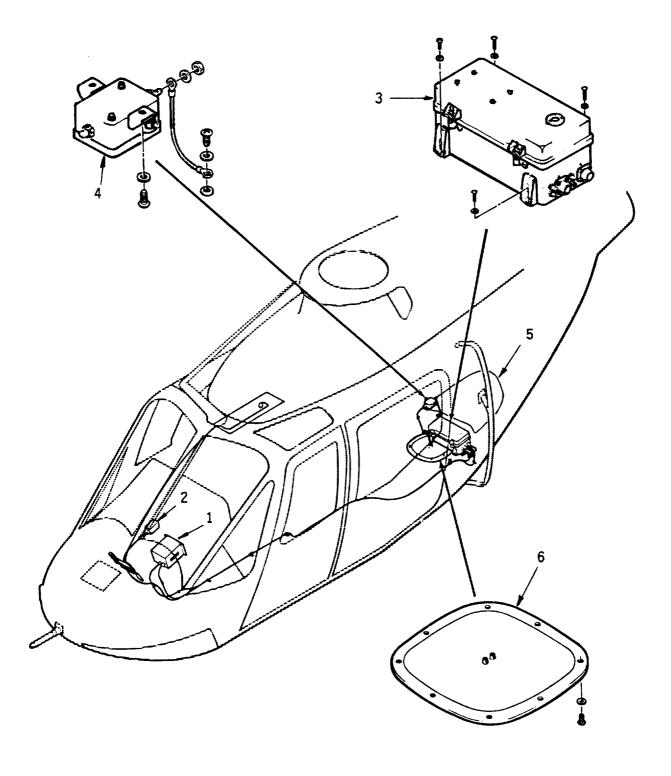


Figure F-6. Direction Finder Set AN/ARN-89 (Sheet 1 of 2)

DRAWI NG DESI GNATI ON	PART <u>NUMBER</u>	FUNCTI ON
1	C-7392()/ARN-89	Control, Radio Set
2	ID-1351()/A	Indicator, Heading Bearing
3	R-1496()/ARN-89	Receiver, Radio
4	AM-4859()/ARN-89	Amplifier, Impedance Matching
5	206-032-310-3	Antenna, Sense
6	AS-2108()/ARN-89	Antenna, Loop

Figure F-6. Direction Finder Set AN/ARN-89 (Sheet 2 of 2)

Table F-6. Wiring Table, ADF AN/ARN-89

WIRE NUMBER	TYPE	END 1	PIN	END 2	PIN
0H-58A					
ARN89-6C22 -6B22 -6A22	SHI ELD SHI ELD SHI ELD	P227 P227 SPLI CE	F D	SPLI CE SPLI CE P201	N
CG-3492/U() * -3493/U() * -3494/U() * -3495/U() *	COAX COAX COAX COAX	P223 P222 P220 P221		P225 P224 P217 P226	
CX-10960/U()	SHI ELD	P219		P218	
0H-58Č					
ARN89-6C22 -6B22 -6A22 CG-3492/U() * CG-3493/U() * CG-3494/U() * CG-3495/U() *	SHI ELD SHI ELD SHI ELD COAX COAX COAX COAX	P227 P227 P227 P223 P222 P220 P221	F D	SPLI CE SPLI CE 3405S1 P225 P224 P217 P226	10
CX-10960/U()	SHI ELD	P219		P218	

*NOTE: Center Conductor of Coax Cable Has 28.0 V dc. Disconnect Before Using TDR.

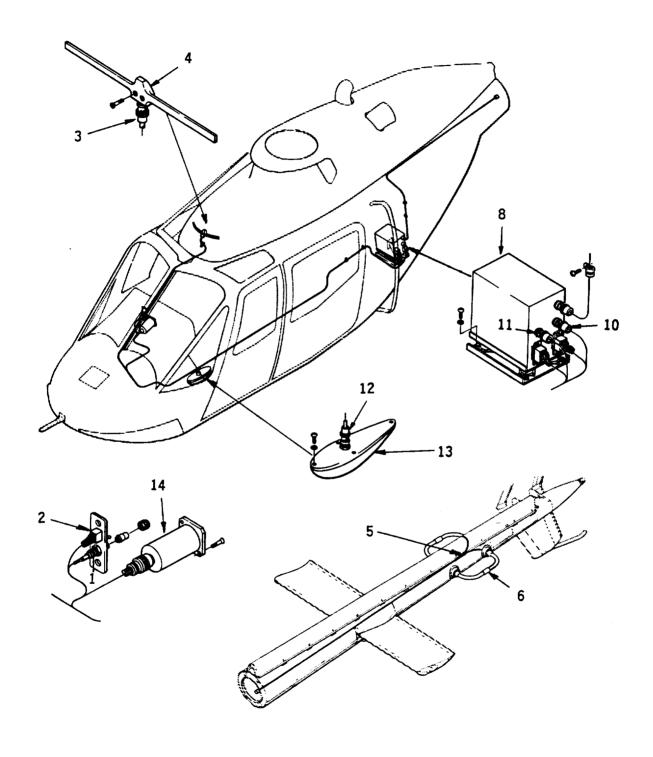


Figure F-7. Radio Receiving Set AN/ARN-123(V)1 (Sheet 1 of 2)

DRAWING DESIGNATION	PART <u>NUMBER</u>	<u>FUNCTI ON</u>
1 2 3 4 5 6 7 8 9 10 11 12 13	MS25041-4 MS27786-23 M39012/16-0004 AS-3188/ARN 5955-00-858-6552 AS-3104()/ARN M39012/16-0004 R-2023/ARN-123(V)1 M39012/16-0004 M39012/16-0004 M39012/16-0004 M39012/16-0004 M39012/16-0004 M1-640/ARN ID-1347C/ARN	Light, Indicator Switch, Toggle, Four Pole Connector, Plug Antenna, Glideslope Spider, Coax Assembly (05211) Antenna Connector, Plug Receiver Connector, Plug Connector, Plug Connector, Plug Connector, Plug Connector, Plug Antenna, Marker Beacon Indicator, Course

NOTE

IF ID-1347C/ARN-82 IS USED WITH THE AN/ARN-123(V), THE SWITCH ON THE BACK OF THE INDICATOR MUST BE SET TO THE R-1388A/ARN-82 POSITION.

Figure F-7. Radio Receiving Set AN/ARN-123(V)1 (Sheet 2 of 2)

Table F-7. Radio Receiving Set AN/ARN 123(V)1 OH-58C

TUDE NUMBER		SCIVING SCL ANTAI		011-300	
WIRE NUMBER	TYPE '	END 1	PIN	END 2	PIN
ARN123-20A22 (WHT)	TWT/S	3405RE1P11001	12	3405S1	3
-20A22 (BLU)	TWT/S	3405RE1P11001	13	3405S1	3 6 9 B
-20A22 (ORN)	TWT/S	3405RE1P11001	25	3405S1	9
-33A22 (WHT)	TWT/S	3405RE1P12002	9	3405DS1P1	В
-33B22	SHI ELD	3405RE1P12002	32	SPLI CE	
-33A22 (BLU)	TWT/S	SPLI CE		SPLI CE	
-34A22 (BLU)	SHI ELD	SPLI CE		SPLI CE	
-33C22		SPLI CE		3405DS1P1	С
-34A22 (WHT)	TWT/S	3405RE1P12002	23	3405DS1P1	H
-35A22 (WHT)	PR/S	3405RE1P12002	8	3405DS1P1	D E G
-35A22 (BLU)	PR/S	3405RE1P12002	33	3405DS1P1	E
-36A22 (WHT)	PR/S	3405RE1P12002	36	3405DS1P1	G
-36A22 (BLU)	PR/S	3405RE1P12002	34	3405DS1P1	F
-38A22 (WHT)	PR/S	3405RE1P12002	15	3405CP1P1	3
-38A22 (BLU)	PR/S	3405RE1P12002	11	3405CP1P1	1
-38B22		SPLI CE		3405CP1P1	1
-39A22 (WHT)	PR/S	3405RE1P12002	4	3405CP1P1	19
-39A22 (BLU)	PR/S	3405RE1P12002	2	3405CP1P1	17
-40A22 (WHT)	TWT/S	3405RE1P12002	7	P201	Р
-40A22 (BLU)	TWT/S	3405RE1P12002	6	P201	R
-40A22 (ORN)	TWT/S	3405RE1P12002	10	GND	
-41A20 (WHT)	PR/S	3405RE1P12002	18	3405T1	
-41A20 (BLU)	PR/S	3405RE1P12002	19	GROUND	

1 Denotes: PR/S----Pair, Twisted, with Shield TWT/S---Three Wire Twisted, with Shield

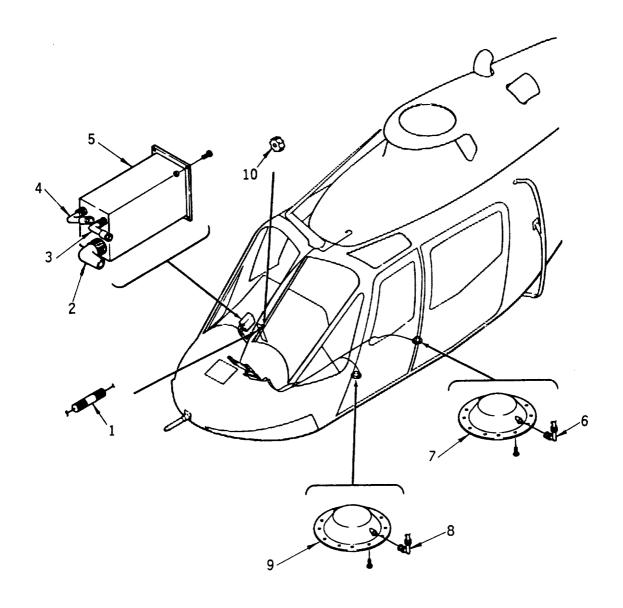


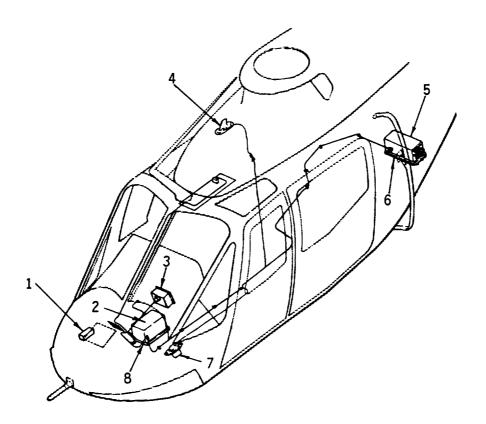
Figure F-8. Radar Altimeter System AN/APN-209 (Sheet 1 of 2)

DRAWI NG DESI GNATI ON	PART <u>NUMBER</u>	FUNCTI ON
1 2 3 4 5 6 7 8 9	M39002/01-0072 MS27473T10835S KA-59-96 KA-59-96 RT-1115/APN-209 KA-59-96 AS-2595/APN-194 KA-59-96 AS-2595/APN-194 MS91528-0N18	Resistor, Fixed Connector, Plug, Electric Connector, Plug Connector, Plug IND., RCVR, Transmitter Connector, Plug Antenna Connector, Plug Antenna Knob, Control

Figure F-8. Radar Altimeter System AN/APN-209 (Sheet 2 of 2)

Table F-8. Wiring Table, Radar Altimeter AN/APN-209 OH-58C

10010101	willing rabi	o, madai mot	O1 / (14/ / (1 14	207 011 000	
WIRE NUMBER	TYPE 1	END 1	PIN	END 2	PIN
APN209-21A APN209-22A	COAX COAX	2408DS1P4 2408DS1P3	J4 J3	3408E1P1 3408E2P1	J1 J1



DRAWI NG <u>DESI GNATI ON</u>	PART <u>NUMBER</u>	<u>FUNCTI ON</u>
1 2 3	TS-1843()/APX RT-859()/APX-72 C-6280A(P)/APX RT-1285/APX-100(V)	Test Set, Transponder Recei ver-Transponder Control, Transponder APX Transponder: The APX-100(V), Used On The OH-58C Does Not Require The TS-1843()/APX
4	206-077-109-1	Antenna: Used Only On OH-58C With APX-100
5	KIT-1A/TSEC	Computer
6	MT-3513/APX	Mount
7	AT-884()/APX	Antenna
8	MT-3809/APX-72	Mount

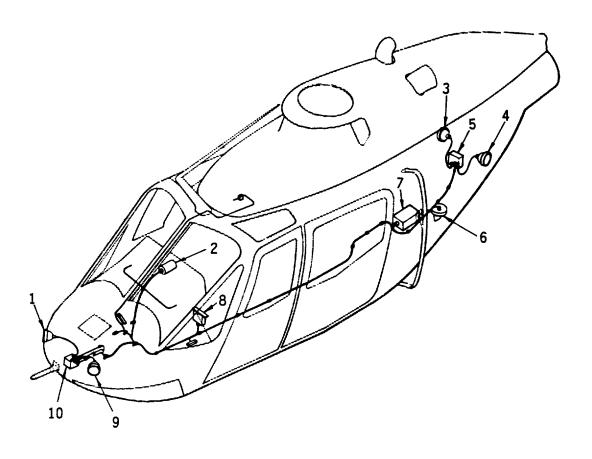
Figure F-9. Transponder (IFF) System AN/APX-72, AN/APX-100

			FF, APX-7		
WIRE NUMBER	TYPE	END 1	PIN	END 2	PIN
SX706A18 SX706B18 SX707A22 SX712A22 SX714A22 SX716A22 SX717A22 SX719A22 SX720A22 SX721A22 SX743A22 SX754A22 SX755A22 SX756A22 SX757A22	SHI ELD	P234 SPLI CE P234 P234 P234 P234 P234 P234 P234 P234	2 4 21 20 19 18 16 15 14 6 40 39 38 37	SPLICE CB2 P232 P232 P232 P232 P232 P232 P232 P2	24 2 11 5 6 8 9 10 31 26 27 28 29
SX758A22 SX761A22 SX762A22 SX763A22 SX764A22 SX765A22 SX766A22 SX768A22 SX768A22 SX803A22	SHI ELD	P234 P234 P234 P234 P234 P234 P234 P232 P234	36 29 28 27 26 25 24 12 9	P232 P232 P232 P232 P232 P232 P232 TB6 J600	30 32 33 35 36 37 38 C3 29
SX804A22 SX817A22 SX818A22 SX819A22 SX820A20 SX821A22 SX822A22 SX823A22	SHI ELD	P234 P234 P234 P234 P234 P234 P234 P234	10 59 43 44 50 56 57 58	TB26 P232 P232 P232 P232 P232 P232 P232 P2	B2 4 15 16 17 18 19 20 25
SX825A20 SX826A22 SX834A20 SX849A22 SX701A SX701B SX828A	SHI ELD SHI ELD SHI ELD COAX COAX COAX	P234 P234 P232 P233 P233 P230 P234	34 51 51 19 45	P232 P232 SPLI CE P232 P236 P235 P233	42 55 3
SX829A SX830A SX831A	COAX COAX COAX	P234 P234 P234	46 47 48	P233 P233 P233	2 3 1 4

TM 55-1520-228-BD APPENDIX F

	F-10. Wiring		APX-100	•	
WIRE NUMBER	TYPE '	END 1	PIN	END 2	PIN
APX100-5048A22(WHT -5048A22(BLU -5001A APX100-5002A	PR/S PR/S COAX COAX	3410TR1P1 3410TR1P1 3410TR5P1 3410TR4P1	21 23	J600 J600 3410E1P2 3410E1P1	29 28
APR39-31A	SHI ELD	3410TR1P1	19	3422Z1P1	22
APX100-5017A -5018A -5019A APX100-5020A	COAX COAX COAX COAX	3410TR1P1 3410TR1P1 3410TR1P1 3410TR1P1	43 45 47 49	3410U1P1 3410U1P1 3410U1P1 3410U1P1	4 2 3 1

1 Denotes: PR/S---Pair, Twisted, with Shield



DRAWI NG <u>DESI GNATI ON</u>	PART <u>NUMBER</u>	<u>FUNCTI ON</u>
1 2 3 4 5 6 7 8 9	AS-2892/APR-39(V) IP-1150()/APR-39 AS-2891/APR-39(V) AS-2892/APR-39(V) R-1838()/APR-39 AS-2890/APR-39(V) CM-440/APR-39(V) C-9326/APR-39(V) AS-2891/APR-39(V) R-1838()/APR-39(V)	Antenna, Left Spiral Indicator, Radar Signal Antenna, Right Spiral Antenna, Left Spiral Receiver, Radar Antenna Comparator Control, Detecting Signal Antenna, Right Spiral Receiver, Radar

Figure F-10. Radar Warning System AN/APR-39

Table F-11. Wiring Table, AN/APR-39

	abi 0 1 111	willing rabi	C, AIV/AF		
WIRE NUMBER	TYPE	END 1	PIN	END 2	PIN
OH-58A					
APR39-1A -2A -3A -4A -9A -15A -17A -23A -30A22 -30B22 -30C22 APR39-31A	COAX COAX COAX COAX COAX COAX COAX SHI ELD SHI ELD SHI ELD COAX	3422Z1P1 3422Z1P1 3422Z1P1 3422Z1P1 3422Z1P2 3422DS1P1 3422Z1P1 3422Z1P1 3422Z1P1 TB20 TB20 3422Z1P1	8 18 19 9 5 7 9 14 C16 D16 21	3422RE1P3 3422RE2P3 3422RE2P4 3422RE1P4 3422E1P1 3422Z1P1 3422RE1P5 3422RE1P4 TB20 P214 P215 P234	5 C15 LL LL 11
OH-58C					
APR39-I A -2A -3A -4A -9A -15A	COAX COAX COAX COAX COAX COAX	3422RE1P3 3422RE2P3 3422RE2P4 3422RE1P4 3422Z1P2 3422Z1P1	J3 J3 J4 J4 J2 5	3422Z1P1 3422Z1P1 3422Z1P1 3422Z1P1 3422E1P1 3422DS1P1	8 18 19 9 J1 5
-17A -23A -30A22 -30B22 -30C22 APR39-31A	COAX COAX SHI ELD SHI ELD SHI ELD COAX	3422RE1P5 3422RE2P5 3422A1P1 TB20 TB20 3422Z1P1	J5 J5 14 C16 D16 22	3422Z1P1 3422Z1P1 TB20 P214 P215 3410TR1P1	7 17 C15 LL LL 19

INDEX

Subj ect		Paragraph
	A	
Allowable Damage Limits		1-3 4-8 4-13 6-5 8-6 9-7
Airframe. Alighting Gear Drive Train System Electrical and Avionics System Environmental Control System Flight Controls System Fuel Systems Hydraulic. Power Plant Rotors		4-2 5-3 8-3 11-2 15-3 13-2 12-2 9-3 6-2 7-3 14-2
	В	
Battery Repair	C	11-23 1-6 15-7 D-6 11-22
		4-18 4-17 11-21 11-15 thru 11-18
Component Bridging		11-19 4-9 11-20

Subj ect	Paragraph
D	
Damage Measurement, Airframe	4-7, 4-12 11-24 11-7 1-4 6-1 4-6 14-4 8-5 8-2 6-6
E E	
Emergency Equipment Description - Emergency Equipment Supplementary Emergency Equipment Information.	19-1 19-2
Environmental Control System Bleed Air Line Damage	15-7 15-6 15-5
F	
Flexible Duct Damage	15-6 13-4 4-19 12-7 9-8 12-6
	2-2
General Fault Assessment Tables . • • • • • • • • • • • • • • • • • •	2-2
	5-6
Hard Landings, Sudden Stops	4-20 9-7 9-11 9-8

Subj ect		Paragraph
	I	
Initial Assessment, Airframe		4-5
	J	
	K	
	L	
Lines and Hose Replacement Low Pressure Sensing Switch Leak Lubricants and Hydraulic Fluids		9-5 8-8 D-6
	M	
Main Rotor Blade, Hole 1 to 4 Inches Dia Manner of Blending Fuels		7-7 D-5
	N	
	0	
Oil Hoses and Lines, Leaks or Restriction Oil Lines (Rigid) Type Repair. Oil Pressure Transmitter Leak. Oil Tank Punctured. Operating Characteristics. O-Ring Damage. O-Ring, Packing, and Gasket Applications		8-9 9-7 8-7 6-7 1-8 12-5 9-10
	Р	
Purpose, BDAR		1-1
	Q	
Quality Deficiency Report/Equipment Impr	rovement Recommendation	1-5

Subj ect		Paragraph
	R	
Repair Plan, Airframe.		4-10
Repair Procedure Index		4-14
Alighting Coor		5-4
Drive Train System		8-4
Flectrical and Avionics System		11-3
Environmental Control System		15-4
Flight Controls System		13-3
Fuel Systems		12-3
Hydraulic	$(a_1, a_2, a_3, a_4, a_4, a_5, a_5, a_5, a_5, a_5, a_5, a_5, a_5$	9-4 6-3
Power Plant	, and the contract of the con	
Rotors	$(a_1,\ldots,a_{r-1},a_{r-$	7-1
Utility Systems	$(x_1, x_2, \dots, x_n, x_n, x_n, x_n, x_n, x_n, x_n, x_n$	14-3 1-11
Reports		15-5
Rotor Blade, Hole 1 Inch Diameter	or Less.	7-6
	S	
		0 5
Sensitivity of Drive Irain System	n to Battlefield Damage.	8-5
	$(x_1, y_1, \dots, y_n) \in \{x_1, x_2, \dots, x_n\} \times \{x_1, x_1, \dots, x_n\} \times \{x_1, x_2, \dots, x_n\} \times \{x_1, x_2, \dots, x_n\} \times \{x_1, x$	11-10
Shielded Cable Repair		11-8 11-9
Shielded Cable Repair Segments .		5-7
SKI U Dalliage		4-16
Shiri-stilleller Dallaye		11-5
Structural Damage Assessment and	Repai r.	4-4
Substitute Emergency Antenna Fig	el d Expedi ent.	44.0=
Supplementary Emergency Equipmen	t Information.	
	T	
	I	
Tagging/Identifying BDAR Repairs		1-10
Tail Boom Skin Damage		4-22
Tail Rotor Gearbox, Bullet Damage	e	8-11
Terminal Boards	and the second of the second o	11-12
Terminal Lugs		11-13
Terminators for Nickel-Plated Shiel	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	11-11
Training		1-9
Transmission-Bullet Damage		8-10
Transmission Oil Cooling-Air Duct	t Repair	8-6
Tube Cutting		9-6 13-3
Tubes, Filght Control		13-3 11-21
Typical Avionics Configuration .		11-21

Subj ect		Paragraph
	U	
	V	
	W	
Waiver of Precautions	d Wires	1-7 4-21 11-14 11-6
	XYZ	

GLOSSARY

NOTE

•The terms and acronyms listed herein are defined in relation to BDAR and accordingly may not be used in the same manner in other manuals.

•Additional definitions of terms, markings, and acronyms used during BDAR assessment procedures will be found under chapter 1, paragraph 1-10, Tagging and Identifying BDAR Repairs.

ABRASION Roughened surface, varying from light to severe.

ALLOWANCE A prescribed difference between the maximum condition of

mating parts. The minimum clearance or maximum inter-

ference between such parts.

API Armor piercing incendary armament round.

ASSEMBLY A group of two or more physically connected and related

parts, capable of disassembly, and when combined with

other assemblies and parts, creates a component.

ASSEMBLY CLEARANCE The actual fit between two or more mating parts with

respect to the amount of clearance or interference

between them.

ASSESSMENT A procedure to rapidly determine what is damaged,

whether it is repairable, what assets are required, who can perform the repair, and where the repair

can made.

ASSOCIATED PARTS A group of parts which could contain one or more

unrelated parts of a subassembly, one or more sub-

assemblies, and attaching hardware.

AXIAL Related to an axis. Describes the linear distance a

shaft or gear moves.

BATTLEFIELD DAMAGE Any incident such as combat damage, random failures,

operator errors, accidents, and wear-out failures which occur on the battlefield and which prevent the equipment/end item from accomplishing its mission.

BEAM A primary structural element designed to carry heavy

loads by resisting bending in one direction. Usually constructed with a channel, tee, or "I" cross section.

BEND Any change in an intended configuration.

BORE Inside measurement of the interior diameter of a hole

or tube. Also used to describe the hole itself.

TM 55-1520-228-BD GLOSSARY

GLOSSARY (Cont)

BOWED Curved or gradual deviation from original line or plane.

BOX BEAM A primary structural element designed to carry heavy

loads by resisting bending in at least two directions characterized by a square or rectangular hollow cross

section.

BRAID Machine woven wire strands.

BREAK Separation of a part or substance from itself.

BRIDGING Jumping or bypassing of a part or component.

BRINELLED Circular indentations on bearing surfaces.

BULKHEAD The primary vertical structural element. Often called

frames or walls.

BUCKLE Wrinkle or crease damage to sheet metal structural

elements.

BURN Loss of metal resulting from overheating.

BURNISHING The smoothing of a metal surface by mechanical action

without loss of material. Generally found on plain bearing surfaces. Surface discoloration is sometimes

present around outer edges of a burnished area.

BURR A rough edge or sharp projection.

CANNIBALIZATION The removal of needed parts or assemblies from other

aircraft, equipment, or from non-essential systems

on the helicopter undergoing repair.

CAP A continuous structural element (angle, tee, or

channel shape) fastened to the top and bottom of

a beam or web.

CATASTROPHIC A sudden and disastrous event caused by equipment

failure which endangers human life.

CHAFED Functional wear. A rubbing action between two parts

having relative motion.

CHECK An examination for verifying.

CHIPPING Breaking away of small metallic particles.

CHORDLINE An imaginary line running perpendicular to the leading or

trailing edge of a rotor blade.

GLOSSARY (Cont)

A circular motion in the direction the hands of a clock **CLOCKWI SE**

rotate when viewed from the front.

COATING. PROTECTIVE

An external surface treatment, such as paint, anodizing, electroplating or chemical film, used to delay the effects of corrosive or atmospheric elements upon metals.

COMBAT CAPABLE The ability of the helicopter to perform the MINIMUM

combat mission assignments.

COMBAT EMERGENCY The ability of the helicopter to perform LIMITED

CAPABLE specific tactical mission assignments.

COMPONENT A group of physically connected assemblies or parts.

CONSUMABLE I TEMS Parts or materials which are consumed by usage or which

have a one-time usage in depot maintenance activity.

CORF The inner layer of material used to construct

honeycomb structural panels.

Surface chemical action which results in surface CORROSI ON

discoloration, a layer of oxide, rust, or removal of

surface metal.

The direction opposite to the direction the hands of a COUNTER-CLOCKWI SE

clock rotate, when viewed from the front.

A break in some type of material. CRACK

CRI PPLE Damage to a load carrying structural member which

would cause degradation of the helicopters full

mission capability.

Standards or rules used to judge. CRI TERI A

A group of facts. DATA

To make an item safe for unprotected personnel by DECONTAMINATION

removing, neutralizing, or destroying any harmful substance. A function of Nuclear, Biological, and

Chemical (NBC) Warfare.

Indentation in metal surface produced by an object DENT

striking with force.

The operations necessary to reduce an assembly to its DI SASSEMBI Y

separate components and parts.

TM 55-1520-228-BD GLOSSARY

GLOSSARY (Cont)

DISTORTION A change from an original shape.

EROSION Wearing away of metal.

EVACUATION A combat service support function which involves the

movement of recovered helicopters from a main supply route, maintenance collection point, or maintenance

activity to higher categories of maintenance.

EXPEDIENT A rapid and often non-standard method of repairing

an item (repair technique).

FAILURE MODE The specific cause of failure, relating to categories

such as cracks, corrosion, ballistic impact, etc.

FATIGUE FAILURE Sharp indentations, cracks, tool marks, or inclusions

that result in progressive yielding of one or more local

areas of material.

FIX Any rapid action that returns a damaged part or

assembly to full or an acceptably degraded operating

condition (repair technique).

FLANGE A broad ridge or pair of ridges projecting from the

edge of a structural element, providing additional

strength or a place for attachment.

FLAKING Loose particles of metal or evidence of separation of a

surface covering material.

FLUORESCENT PENETRANT A test for locating cracks and fissures in non-

magnetic material, making use of radiation properties of fluorescent particles when exposed to ultraviolet

light.

FORMER A curved structural element which gives the fuselage

its even aerodynamic shape. Normally longerons and

stringers are attached and the skin is fitted

tightly over all these elements.

FRACTURE Separation of a part or piece of material from itself.

FRAYING Loose or raveled threads and fibers.

FULLY MISSION The ability of the helicopter to perform ALL its combat

CAPABLE (FMC) mission assignments.

FUNCTIONAL GROUP Major helicopter subsystems identified in and

corresponding to functional groups in TM 55-1520-236-23.

FUSELAGE The central main body of the helicopter.

GLOSSARY (Cont)

GALLING Aggravated condition of wear, generally caused by a

rubbing action with little or no lubrication.

Clearance between faying surfaces, measurement of which GAP

is used to determine thickness of shims.

Removal of surface metal because of mechanical contact GOUGI NG

with foreign material.

A change in color or appearance of a part, caused by HEAT DISCOLORATION

excessive temperature.

High explosive incendiary armament round. HEI

HOUSI NG A frame support or cover, used to hold parts of

machinery in place. Also used as a protective cover.

A cavity with smooth bottom or sides, which can occur I NDFNTATI ON

on rolling contact surfaces.

A critical examination of parts to determine their use-I NSPECTI ON

fulness or condition.

The joining point of two flat surfaces. INTERFACE

JURY-RIGGING A rapid non-standard method of repairing an item

(repair technique).

An established point or boundary, in time, speed, or LIMIT

space, beyond which something may not go or is not

permitted to go.

The route taken by a mechanical force traveling through LOAD PATH

an airframe structure.

A principle longitudinal (fore and aft), structural LONGERON

element (angle or tee shape) continuous across several

points of support.

Line replaceable unit (electronic circuit board). I RU

MAINTENANCE COLLECTION

POI NT

A point operated by AVIM units for the collection of

equipment for repair.

MAINTENANCE SUPPORT

TEAM (MST)

A team consisting of AVUM and AVIM mechanics and technical specialist who are trained in assessing battle damage in

addition to their routine speciality.

TM 55-1520-228-BD GLOSSARY

(MT)

(MFCC)

GLOSSARY (Cont)

MAINTENANCE TEAM A team consisting of organizational mechanics who may

be trained in assessing battle damage and field repair

procedures.

MISSION FUNCTION The ability of the helicopter to perform the MINIMUM

COMBAT CAPABLE combat mission assignments.

MODIFICATION An alteration and/or integral change affecting the

configuration of equipment or its respective parts,

components, subassemblies, or assemblies.

NATIONAL STOCK NUMBER The assigned identifying number for an item of

(NSN) supply, consisting of the four-digit Federal Supply

Class (FSC), and the nine-digit National Stock

Identification Number (NIIN).

NICK A local break or notch in the edge of material.

OPERATION Performance of a practical, functional action.

OPTION A specific BDAR repair technique often non-standard

in nature.

OVERHAUL The process of repairing or adjusting a machine to

restore, improve, or lengthen its useful life.

PEELING A breaking away of surface finishes such as coatings

or platings, or flaking of large pieces of such material.

PIGTALL A group of electrical wire strands twisted together.

PITTING Small holes or indentations, generally caused by rust,

corrosion, high compressive stresses, or metal-to-metal

poundi ng.

PRACTICE A repeated or customary action.

PRIMARY STRUCTURE The major structural load carrying elements of an

airframe without which helicopter flight safety would

be compromised.

PROCEDURE A particular course of action.

PROCESS A series of actions conducive to an end.

PYLON The box shaped structural area surrounding the helicopter

main transmission. This area carries several primary

structural Loads.

GLOSSARY (Cont)

REASSEMBLY The assembling and aligning of all subassemblies and

parts into a complete assembly to affect a serviceable

item of equipment.

RECOVERY The retrival of immobile, inoperative, or abandoned

helicopters from the battlefield or immediate vicinity and its movement to a maintenance collection point, main supply route, or a maintenance activity for disposition,

repair, or evacuation.

REMOVE To move by lifting, pulling or pushing.

REPAIR To restore a defective part, component, subassembly, or

assembly to a usable condition in accordance with the

instructions contained in this manual.

REPLACE To supply an equivalent for.

REWORK To work over again.

RUPTURE The breaking of an airframe structural element or skin

due to overstress/hostile fire.

SCORING Very deep scratches caused by foreign particles between

surfaces that are moving, or between one moving and one stationary surface. Scores follow the travel

direction of the part.

SCRATCHING Narrow, shallow lines resulting from movement of

foreign particles across a surface.

SECONDARY STRUCTURE The non-flight safety structural elements of an airframe.

SELF-RECOVERY The ability of the helicopter to fly at reduced airspeed

and altitude from the battlefield or immediate vicinity to a maintenance collection point, the main supply route,

or maintenance activity for disposition, repair or

evacuati on.

SEMIMONOCOQUE A structural design which relies on strength of the skin

to carry a large portion of the load. The skin is normally reinforced by longerons and vertical bulkheads (walls), but has no diagonal bracing, leaving the interior

basicly hollow.

SERVICING The lubrication, treating, cleaning, or preservation

necessary to maintain the equipment and other respective

parts in serviceable condition.

SKIN The aerodynamic exterior covering of the helicopter.

TM 55-1520-228-BD GLOSSARY

GLOSSARY (Cont)

SPALLING Chipped or flaked surface caused by the breaking away of

the hardened metal and separation of the case from the

core.

SPANWISE The location of a point or direction of movement parallel

to the leading or trailing edge of a rotor blade.

SPAR A primary structural element designed to carry weight

and resist bending loads in wings and rotor blades. Spars typically extend the full length of the wing, and taper down to a smaller cross section toward the tip

of the wing.

STIFFENER A longitudinal (fore and aft) structural element use in

semi monocoque design which stiffens the skin. Often

called a stringer.

STOP HOLE A hole intentionally drilled at the end of a crack, or saw

cut which normally will prevent further propagation

of the crack.

STRINGER A longitudinal (fore and aft) structural element used in

semi monocoque design which stiffens the skin. Often

called a stiffener.

TEST As used herein, the checking or operation of equipment

to determine that the unit functions properly within the

limits set forth in this manual.

TOLERANCE The difference between two limiting sizes as a

means of specifying the degree of accuracy.

TOXIC A poi sonous substance.

TWIST The damage of a structural element by turning or torque

forces causing permanent deformation.

VISCOSITY The property of a fluid that tends to resist the force

trying to make it flow such as gravity or applied

pressure.

WARPAGE The bending or twisting damage causing a structural

element to weaken and permanently loose its original

shape.

WEB The sheet metal membrain connecting the upper and lower

flanges of a beam or spar. Provides overall rigidity to

the airframe structure.

WHIP The tendency of a bent shaft to rotate away from its

original center as the shaft RPM is increased, thus

causing severe vibration.

By Order of the Secretary of the Army

CARL E. VUONO General, United States Army Chief of Staff

Official:

THOMAS F. SIKORA Brigadier General, United States Army The Adjutant General

DISTRIBUTION:

To be distributed in accordance with DA Form 12-31, AVUM and AVIM Maintenance requirements for OH-58A and OH-58C Helicopter Observation.

*U.S.GOVERNMENT PRINTING OFFICE: 1991554-122/21097



TEAR ALONG PERFORATED LINE

SOMETHING WRONG WITH THIS PUBLICATION?

THEN. JOT DOWN THE DOPE ABOUT IT ON THIS FORM, CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

PFC JOHN DOE

COA, 3d ENGINEER BN

FT. LEGHARDWOOD, MO. 63108

DATE SENT

PUBLICATION NUMBER PUBLICATION DATE PUBLICATION TITLE BE EXACT. PIN-POINT WHERE IT IS IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT: PARA-GRAPH FIGURE NO TABLE 2-1 BI 4-3 20 125 PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER SIGN HERE JOHN DOE, PFC (268) 317.7111 OHN

DA 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

DRSTS-M Overprint 1, 1 Nov 80

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.



FOLD BACK

TEAR ALONG PERFORATED LINE

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

Commander
US Army Aviation Systems Command
ATTN: AMSAV-MC
4300 Goodfellow Boulevard

St. Louis, MO 63120-1798

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



something wrong WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

IOT DOWN THE

2		17	DOPE AE FORM, C. OUT, FO	BOUT IT AREFUL LD IT AI	ON THIS LY TEAR IT ND DROP IT		
		P (IN THE .	MAIL!		DATE	
PUBLICAT	TION NUMB	ER			PUBLICATION DA	ATE	PASSESSMENT AND REPAIR FOR HELI- COPTER, OBSERVATION OH-58A
	-1520-2				4 JANUARY	1991	& OH-58C
BE EXACT. PIN-POINT WHERE IT IS PAGE PARA FIGURE TABLE			IN THIS	S SPACE TELL Y	NHAT I	S WRONG E ABOUT IT:	
NO	GRAPH	NO	NO				
i							
	<u> </u>	<u></u>		<u> </u>			
PRINTED	NAME GRAC	YE OR TITLE	AND TELEF	HONE NUM	BEA	SIGN H	ERE

	FILL IN YOUR UNIT'S ADDRESS
DEPART	MENT OF THE ARMY
0	FFICIAL BUSINESS

Commander
US Army Aviation Systems Command
ATTN: AMSAV-MC
4300 Goodfellow Boulevard
St. Louis, MO 63120-1798

FOLD BACK

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



PIN-POINT WHERE IT IS

BE EXACT.

SOMETHING WRONG

WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

THEN. JOT DOWN THE DOPE ABOUT IT ON THIS FORM, CAREFULLY TEAR IT OUT. FOLD IT AND DROP IT IN THE MAIL!

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR FOR HELI-
TM 55-1520-228-BD		COPTER, OBSERVATION OH-58A

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

ı	NO	GRAPH	NO	NO		DE DONE ADOUT !!	•	
ı								
I								
I	l							
I	1							
ı								
1								
١	1							
ı								
1								
ı								
ı								
Ì								
I								
I								
1				1				
ı			l					
Ì								
I		ļ		ł				
Ì				1				
ı								
				1				
					1			•
i			1					
				1				
		İ	ł					
			l	}				
		1	l	1				
		[1					
			İ	1				
		<u> </u>	1	}				
			1					
	PRINTED	NAME GRA	DE OR TITLE	AND TELE	PHONE NUMBER	SIGN HERE		
	I							

DA 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE

PS-IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR MEADQUARTERS

FILL IN YOUR UNIT'S ADDRESS	FOLD BACK
DEPARTMENT OF THE ARMY	
	
OFFICIAL BUSINESS	

Commander
US Army Aviation Systems Command
ATTN: AMSAV-MC
4300 Goodfellow Boulevard
St. Louis, MO 63120-1798

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



SOMETHING WRONG WITH THIS PUBLICATION?

THEN. JOT DOWN THE DOPE ABOUT IT ON THIS FORM, CAREFULLY TEAR IT OUT. FOLD IT AND DROP IT IN THE MAIL!

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER

PUBLICATION DATE

PASSESSMENT AND REPAIR FOR HELI-COPTER, OBSERVATION OH-58A

TM 55-1520-228-BD				4 JANUARY 1991 & OH-58C		
BE EXACT. PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG		
PAGE NO	PARA- GRAPH	FIGURE NO	TABLE NO	AND WHAT SHOULD BE DONE ABOUT IT:		
	}					
				İ		
		ļ	[
	1					
				i		
	1					
		1	1			
	Ī					
1						
1	1					
			1	1		
PRINTED	NAME GRA	DE OR TITLE	AND TELEF	PHONE NUMBER SIGN HERE		
•						
				.		

TEAR ALONG PERFORATED LINE

	FILL IN YOUR UNIT'S ADDRESS	
	<u> </u>	
DEPART	MENT OF TH	E ARMY
		
01	FFICIAL BUSINE	:33

Commander
US Army Aviation Systems Command
ATTN: AMSAV-MC

FOLD BACK

4300 Goodfellow Boulevard St. Louis, MO 63120-1798

The Metric System and Equivalents

Linear Measure Liquid Measure

1 centimeter = 10 millimeters = .39 inch 1 decimeter = 10 centimeter = 3.94 inches 1 meter = 10 decimeters = 39.37 inches 1 dekameter = 10 meters = 32.8 feet 1 hectometer = 10 dekameters = 328.08 feet 1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain 1 decigram = 10 centigrams = 1.54 grains 1 gram = 10 decigram = .035 ounce 1 dekagram = 10 grams = .35 ounce 1 hectogram = 10 dekagrams = 3.52 ounces 1 kilogram = 10 hectograms = 2.2 pounds 1 quintal = 100 kilograms = 220.46 pounds 1 metric ton = 10 quintals = 1.1 short tons •

1 centiliter = 10 milliters = .34 fl. ounce 1 deciliter = 10 centiliters = 3.38 fl. ounces 1 liter = 10 deciliters = 33.81 fl. ounces 1 dekaliter = 10 liters = 2.64 gallons 1 hectoliter = 10 dekaliters = 26.42 gallons 1 kiloliter = 10 hectolitas = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	To	Multiply by	To change	To	Multiply by
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit	5/9 (after	Celsius	°C
	temperature	subtracting 32)	temperature	